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Essays on Corporate Finance

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To my family

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Abstracts

This thesis consists of three essays. The first, titled "Do institutional investors care about corporate social responsibility and irresponsibility?" investigates how Corporate Social Responsibility (CSR) and Corporate Social Irresponsibility (CSiR) change when the degree of monitoring by institutional investors varies. We exploit changes in institutional investor distraction due to extreme events in unrelated industries, which is a plausible exogenous source of variation in monitoring intensity. We show that tighter monitoring reduces both CSR and CSiR. The impact on the former is mainly found in contexts prone to agency conflicts, while the effect on the latter is concentrated in settings where there is a demand for advising. Our results are robust to alternative definitions of monitoring intensity and CSR.

In the second chapter, "The bright side of stock repurchases," I provide evidence of actual stock repurchases increasing future investment in firms subject to strong asymmetric information that are reliant on external capital markets. To address endogeneity, I use an instrumental variables approach based on price pressures created by mutual funds' liquidity needs. The results are consistent with firms using actual repurchases to signal their type, which eases access to capital markets and ultimately improves real outcomes.

The third chapter, "The role of accounting quality during mutual fund fire sales," explores the role of accounting quality in mitigating firm's undervaluation in the stock market generated by mutual funds liquidity needs, which is plausible exogenous to firms prospects. We find that the prices of firms with better accounting quality have lower deviations from fundamental value compared to their lower quality counterparts. We show that the results hold after controlling for firm complexity, alternative definitions of accounting quality, and model specifications. Our results indicate that accounting quality plays a crucial role in enhancing market efficiency during severe mispricing periods.

Contents

Chapter 1

Do institutional investors care about corporate social responsibility and irresponsibility?

1.1 Introduction

Institutional investors are the largest type of shareholder in public corporations in the United States, owning approximately 70% of total shares outstanding. Empirical evidence shows that they influence corporate policies and governance. Institutional investors are generally a key monitoring agent for corporate governance. They promote performance-based CEO compensation (Almazan, Hartzell, and Starks, 2005), improve merger outcomes (Chen, Harford, and Li, 2007; Fich, Harford, and Tran, 2015; Kempf, Manconi, and Spalt, 2017), and actively influence corporate policies such as innovation and payout (Bushee, 1998; Aghion, Van Reenen, and Zingales, 2013; Crane, Michenaud, and Weston, 2016; Appel, Gormley, and Keim, 2016; Bena, Ferreira, Matos, and Pires, 2017; Bird and Karolyi, 2017). In this study, we investigate how monitoring by institutional investors shapes Corporate Social Responsibility (CSR) and Corporate Social Irresponsibility (CSiR). Using an exogenous source of variation in monitoring by institutional investors, we show that tighter monitoring by this type of shareholder reduces both CSR and CSiR. While the reduction in the former is driven by firms prone

to agency conflicts, the drop in the latter is cause by firm with a larger need for external advising.

CSR is defined as the set of proactive policies that a firm voluntarily adopts to improve the wellbeing of various stakeholders and society at large, including charitable contributions and voluntary programs for employees (Di Giuli and Kostovetsky, 2014). These activities are beyond the requirement of the law (Mosley, Pietri, and Megginson, 1996). Conversely, CSiR captures social and environmental misbehavior linked to future economic penalties or civil fines (Di Giuli and Kostovetsky, 2014; Ioannou and Serafeim, 2015; Krüger, 2015). At present, there is increasing interest in the extent to which companies are aligning their economic objectives with the social and environmental needs of the communities in which they run their businesses. Companies worldwide are taking social and environmental objectives into account when designing their corporate strategies. For instance, firms in the Fortune 500 are spending more than $15 billion dollars yearly in a wide range of social and environmental activities, such as in-kind donations, cash contributions or employee volunteer programs (Smith, 2014).

The literature on CSR proposes on the one hand, that these activities enhance shareholder value by developing a competitive advantage. This competitive advantage would arise from efficient contracting with different stakeholders of the corporation (Deng, Kang, and Low, 2013). Alternatively, Godfrey, Merrill, and Hansen (2009) and Hong and Liskovich (2014) argue that CSR might work as insurance (preserving economic value rather than creating it). On the other hand, the literature also suggests that these activities can destroy shareholders' value when the cost of these activities do not compensate its benefits (Friedman, 1970; Jensen and Meckling, 1976; Bénabou and Tirole, 2010). This value destruction can arise from the discretion of managers, whose interests are not aligned with those of shareholders (Hong, Kubik, and Scheinkman, 2012; Di Giuli and Kostovetsky, 2014; Masulis and Reza, 2015; Adhikari, 2016).[1] Meanwhile, the literature on CSiR suggests that reducing CSiR might lead to lower future costs (Chatterji, Levine, and Toffel, 2009; Dimson, Karakas, and Xi, 2015) and lower stock return volatility (Bansal and Clelland, 2004; Godfrey et al., 2009; Hoepner, Oikonomou, Sautner, Starks, and Zhou, 2016).[2] However, the benefits

[1] In line with this argument, Davidson, Dey, and Smith (2016) find that CEO preferences explains 63% of the variation in CSR (while firms explain 20%), but they do not find a lower accounting performance in firms with CSR-friendly CEOs.

[2] For instance, an oil spill or a controversial firing decision will certainly lead to cash

of corporate misbehavior could outweigh its costs. For instance, Borisov, Goldman, and Gupta (2015) show that unethical lobbying creates value for shareholders through potentially corrupt arrangements with policy makers, while Yu and Yu (2011) provide evidence of lobbying firms having significant lower hazard rate of being discovered, and being less likely to be detected by regulators.

Institutional investors have large and diversified portfolios of assets. They not only care about individual firms' performance but also the overall return on the portfolio in which they invest (Hansen and Lott, 1996). Regarding the former, at the firm level, they will favor value-enhancing actions and discourage value-destroying policies. At the portfolio level, firm policies might have externalities that will affect the return of the other portfolio assets. Borah and Tellis (2016) show that bad news travel fast on social media and that a recall event can have harmful effects on the sales and stock market performance of innocent rivals. Therefore, institutional investors have incentives to encourage actions that lead to positive spillovers and discourage those with negative externalities. Giannetti and Wang (2016) show that scandals in one state erode trust in the stock market, reducing household stock market participation not only in the state in which the fraud occurs but also states where no fraud occurred. In other words, even when some risks are idiosyncratic to the firm, they might not be diversified away just by investing in a broader set of stocks. Similarly, Borah and Tellis (2016) analyze the *perverse halo* (or negative spillover) effect of social media, defined as a phenomenon whereby negative chatter about one brand increases negative chatter about another brand in the automobile industry. They find that *"a one-unit shock in concerns about Honda has a significant negative impact on Toyota's abnormal returns (...) In dollar terms, this drop translates into a loss of approximately $7.3 million from Toyota's average market capitalization."* (Borah and Tellis, 2016, pp. 155). The contagion effect among households, industry peers and stocks creates incentives for institutional investors to monitor managers to minimize the probability of facing social and environmental misbehavior.

Monitoring efforts by institutional investors are not randomly assigned. Therefore, we use a plausible source of exogenous variation in monitoring intensity by this type of shareholder (Kempf et al., 2017; Ben-Rephael, Da, and Israelsen, 2017a; Liu, Low, Masulis, and Zhang, 2017). We analyze how

outflows in the form of penalties or settlements and increase firm risk. It can also lead to substantial reputational costs.

CSR and CSiR change when institutional investors deviate their attention away from the firm for reasons unrelated to that firm. Following Kempf et al. (2017), we exploit the fact that when stock returns in one industry are extremely high or low, shareholders shift their attention to the firms in their portfolio that belong to those industries, paying less attention to the rest of their investments. This loosening of monitoring activities not only creates an opportunity for managers to extract rents from shareholders, but also blocks managers access to external advising. We find that CSR increases when institutional investors are distracted, consistent with the literature suggesting that this investors deter those activities that destroy value (Hong et al., 2012; Di Giuli and Kostovetsky, 2014; Adhikari, 2016; Masulis and Reza, 2015). We also find that distraction increases CSiR, consistent with institutional investors promoting activities that are more likely to lead to increases in shareholder value (Chatterji et al., 2009; Dimson et al., 2015; Bansal and Clelland, 2004; Godfrey et al., 2009; Hoepner et al., 2016).

Institutional investors often do not content themselves with the *pure monitoring* of managerial decision making (e.g., Jensen and Meckling, 1976; Jensen, 1986; Almazan et al., 2005) but offer expertise and *external advising* to aid the top management team (e.g., Lerner, 1995; Casamatta, 2003; Repullo and Suarez, 2004; Tirole, 2010). We explore the effect of institutional investor monitoring in settings prone to agency conflicts (entrenched CEOs and large free cash flows) and those where advising is more valuable or necessary (recently appointed CEOs or short-tenured directors). We find that institutional investor distraction leads to larger levels of CSR only in settings that are prone to present agency conflicts. Whereas, institutional investor attention leads to decreases in CSiR in settings where external advising is more necessary.

Our results are robust to alternative definitions of institutional investor monitoring, CSR, and the timing of the effect. First, we assume that the larger the fraction of shares owned by institutional investors is, the tighter the monitoring. Thus, we exploit variation in institutional ownership due to assignment to the Russell 1000/2000 Indexes (Appel et al., 2016; Crane et al., 2016).[3] The instrument exploits the fact that institutional investors are often benchmarked against an index, and they own shares of index constituents in proportion to the weight that each stock possesses in the index.

[3]Both indexes are widely used benchmarks, and comparable amounts of money are invested in each of them (Chang, Hong, and Liskovich, 2015).

By construction, there is a discontinuity around the bottom firms of the Russell 1000 and the top firms of the Russell 2000. This mechanical increase in institutional investor ownership exogenously increases monitoring intensity in treated firms, which allows for a causal interpretation of the results. The results from this alternative setting match our main findings. Moreover, this alternative framework allows us to explore the effect of institutional investors with different investment horizons. We document that our results are driven primarily by investors with a long-term focus. In addition, we show robustness tests for alternative measures of CSR provided by Thomson Reuters' ESG Scores (formerly known as ASSET4 Equally Weighted Ratings) and employed in previous literature (Dyck, Lins, Roth, and Wagner, 2018).[4] We find that institutional investor distraction leads to larger levels of CSR, again, in settings prone to agency conflicts. Finally, we address concerns regarding the timing of CSR and CSiR, because previous literature suggests that changes in social and environmental policies arise with some lag (e.g., Adhikari, 2016). We show that our results are statistically more significant when we measure CSR and CSiR in the following year.

There is ample evidence that institutional investors use shareholders' proposals as a mechanism to change governance policies (see, for instance, Appel et al., 2016; McCahery, Sautner, and Starks, 2016). Less attention has been paid to the mechanisms through which institutional investors affect CS(i)R. We show distraction does not seem to affect the number of social and environmental proposals submitted at shareholder meetings, and provide anecdotal evidence that there could be some shareholders taking advantage of institutional investors distraction to pursue their own agendas and increase social and environmental proposals. Nevertheless, recent empirical evidence suggests that institutional investors prefer to engage behind-the-curtain, via constructive dialogue through various engagement actions such as meetings, calls, emails or letters (McCahery et al., 2016; Hoepner et al., 2016).

Various studies attempt to empirically assess the relationship between institutional ownership and CSR (see Coffey and Fryxell, 1991; Graves and Waddock, 1994; Johnson and Greening, 1999; Neubaum and Zahra, 2006; Dyck et al., 2018). Coffey and Fryxell (1991) find contradictory results using different measures of CSR. They find a positive relationship between institu-

[4]Unfortunaltely, we cannot provide a robustness test to CSiR using Thomson Reuters ESG Scores as they are aggregated across the social, environmental and governance dimensions. We exclude the governance category from our dependent measures in all of our analyses following previous literature (e.g., Di Giuli and Kostovetsky, 2014).

tional ownership and the number of women on the board but a negative relationship for compliance with the Sullivan principles.[5] Graves and Waddock (1994) is the first study that measures CSR using KLD (now the MSCI ESG database), the most widely used database for empirical CSR studies. The authors investigate the effect of CSR on institutional investment and find that CSR increases the number of institutional investors that participate in the ownership structure of the firm, but they find no effect for the percentage of institutional ownership. Similarly, Johnson and Greening (1999) distinguish among different types of institutional investors, i.e., pension funds, mutual and investment banks, and foundations. They argue that pension funds have the right incentives to strive for CSR, as they have a long-term investment horizon and face difficulty in exiting their positions. The authors provide evidence of a positive association between this type of institutional investor and CSR. Similarly, Neubaum and Zahra (2006) distinguish among different institutional investors based on their investment strategy. The authors find a positive relationship between institutional ownership by public pension funds and CSR, moderated by activism and coordination.[6] Overall, all studies share similar empirical characteristics, as they do not account for reverse causality, omitted variables, or measurement error, which are likely to have entailed some misspecification. Our study differs from the previous literature because we use the undiluted measures from the MSCI ESG database and employ two sources of exogenous variation in monitoring intensity by institutional investors that allow us to provide causal evidence.

The closest paper to ours is the article by Dyck et al. (2018), which studies the impact of institutional ownership on the environmental and social performance of an international sample. The authors find that institutional ownership has a positive impact on firms' social and environmental performance, and argue for the causality of the relationship using the BP Deepwater Horizon oil spill in 2010 as an exogenous negative shock that increased demand for larger environmental performance. Our results differ from Dyck et al. (2018) in the scope of our samples, our measurement of CSR and the different sources of exogneous variation employed. Our sample comprises firms incorporated in the US, whereas Dyck et al. (2018) make use of an international sample and do not include US firms in their main analyses. There

[5]The Sullivan principles were intended to create equal treatment of employees regardless of their race in South Africa during Apartheid.

[6]They measure activism and coordination by inspecting news coverage of public activities carried out by institutional investors.

is no reason to believe that the effect of institutional investors on social and environmental issues will be the same in different countries. For instance, Edmans, Li, and Zhang (2017) documents an increase in firm value due to employee satisfaction in countries with flexible labor markets (such as the US), but not for countries with rigidities (e.g., Germany). Moreover, the authors measure environmental and social performance using a net measure from Thomson Reuters ESG database, while we separate CSR from CSiR and use the MSCI ESG database. However, that cannot explain the differences with our papers, because our results are robust to both databases.[7] Finally, the authors make use of the BP Deepwater Horizon oil spill in 2010 as an exogenous increase in the demand for environmental performance by institutional investors, which could be an extreme event in which the reaction of institutional investors differs from other situations.

Our paper is also related to the literature on the effect of institutional investors and monitoring on corporate governance. In the context of CEO compensation, Almazan et al. (2005) find that pay-for-performance sensitivity is positively related to active institutional ownership. A recent body of literature analyzes the monitoring role of institutional investors in the context of markets for corporate control (see, for instance, Chen et al., 2007; Fich et al., 2015; Kempf et al., 2017). Chen et al. (2007) show that large holdings by this type of investor predict post-merger performance and that there is a positive association between firms' withdrawal from the worst deals and their presence in the firm. Furthermore, Fich et al. (2015) show that institutional investors produce better acquisition outcomes such as increased bid completion rates, higher premiums, and lower acquirer returns. Similarly, Kempf et al. (2017) find that when institutional shareholders are distracted (a setting with looser shareholder monitoring), managers engage in value-destroying acquisitions. Finally, institutional investors posses the incentives and means to actively shape corporate policies such as innovation and dividend payout (Aghion et al., 2013; Crane et al., 2016; Bena et al., 2017). We add to these sets of papers by showing that institutional investors play a pure monitoring role with respect to CSR and an advisory role regarding CSiR.

We contribute to the literature in several ways. First, we provide causal evidence of institutional investors decreasing current levels of CSR activities,

[7] In Table 7, we report the impact of institutional investor distraction on Thomson Reuters' social and environmental scores as dependent variables. Unfortunately, we cannot make use of the variation in institutional ownership due to the Russell 1000/2000 threshold, because ASSET4 covers only firms quoted in the Russell 1000 index.

contrary to prior archival evidence using two exogenous sources of variation in institutional investor monitoring intensity. We further contribute to the literature by showing that CSR and CSiR are different empirical constructs that proxy for distinct types of corporate responsibility. In other words, increasing CSR might not be equivalent to decreasing CSiR, and using proxies based on the combination of strengths and concerns might not be fully informative. To the best of our knowledge, this is the first study to examine the impact of monitoring by institutional investors on CSiR. We also add to the literature by showing that institutional investor *pure monitoring* leads to decreases in CSR, while their role as *external advisors* reduces CSiR. Finally, we examine shareholder-initiated social and environmental proposals as a mechanism through which institutional investors might affect CS(i)R.

1.2 Data and empirical framework

1.2.1 CSR and CSiR measures

Following previous literature, we define our proxy for CSR as the number of strengths that a firm has in a given year from MSCI ESG (formerly KLD) (Kacperczyk, 2009; Flammer, 2015; Ioannou and Serafeim, 2015). This measure is intended to capture management best practices concerning community relations, diversity issues, environmental policies, employee relations or product characteristics that do not necessarily have a direct link to firm value.[8] Moreover, we separately analyze each of the components. CSR comprises items such as charitable giving, volunteer programs for employees, cash profit-sharing programs for the workforce, or pollution prevention programs. Some of these items require substantial resources from firms (Hong and Liskovich, 2014). For instance, to obtain an extra CSR point, a firm must consistently give over 1.5% of three-year net earnings to charity or have a notably strong retirement benefits program. Conversely, we define CSiR as the number of concerns that a firm has in a given year from MSCI ESG. CSiR comprises social and environmental misconduct that has a direct impact on earnings, through the recognition of expenses such as fines and penalties. This construct includes items such as tax disputes involving the federal, state or local government, regulatory problems regarding environmental practices, major

[8]Following previous studies, we drop the governance and human rights dimensions of MSCI ESG when constructing our measure of CSR (Flammer, 2018; Davidson et al., 2016).

controversies or regulatory actions related to antitrust allegations, or investment controversies related to the Community Reinvestment Act. In addition to the overall measure of CSiR, we analyze its individual components.

There is no consensus on how CSR should be measured. While some studies only consider the number of CSR strengths from MSCI ESG (Kacperczyk, 2009; Flammer, 2015; Ioannou and Serafeim, 2015), other papers take the difference between the number of CSR strengths and concerns to construct an overall index of CSR (Di Giuli and Kostovetsky, 2014; Adhikari, 2016). Mattingly and Berman (2006) argue that strengths and concerns coming from the MSCI ESG database do not covary and thus should not be aggregated. Following Kacperczyk (2009), Ioannou and Serafeim (2015), and Krüger (2015), we separate MSCI ESG strengths and concerns to measure CSR and CSiR, respectively. This is because concerns are theoretically and empirically a different construct from strengths. The empirical evidence confirms that CSR and CSiR differ. Chatterji et al. (2009) find that CSiR (measured as the number of MSCI ESG environmental concerns) is a better predictor of future environmental performance than is the number of strengths. Krüger (2015) provides evidence on the short-run effect of corporate social responsibility on shareholder value through a window event analysis using social and environmentally related news.[9] His findings suggest that markets react moderately negatively to news about strengths but more negatively to news related to concerns.

1.2.2 Sample selection

Our main sample covers 8 years – 2003 to 2010. Since 2003, MSCI ESG, our main database for CS(i)R, provides information for firms in the Russell 1000 and Russell 2000. However, in 2011, there was a change in methodology, which is why we use 2010 as the last year in our sample. We also collect governance variables from MSCI ESG. We use Compustat for accounting variables and the Thomson 13F Database for institutional ownership data. In addition, we use data collected by ISS (formerly Riskmetrics) on shareholder proposals regarding socially responsible investment. We drop firms with

[9]He distinguishes between news associated with strengths and concerns—for instance, being included on the list of the 100 best places to work for mothers would be related to a diversity strength—and the announcement of a Securities and Exchange Commission formal investigation in the accounting of a firm would be related to a concern (see Figure 2 in Krüger (2015)).

missing values for total assets. Finally, to mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

Panel A of Table 1 presents descriptive statistics of the main variables used in this paper. On average, our firms are smaller than those in previous studies, as we consider firms in the Russell 3000. In our sample, the mean size is 7.87 (natural logarithm of total assets), while in Flammer (2015), the mean size is approximately 8, and that in Deng et al. (2013) is approximately 9.1. Because CSR is increasing in firm size, our sample firms have lower CSR. The mean (median) score is 1.7 (1). The mean and median CSiR score are 1.7 and 1, respectively, which are comparable to Adhikari (2016). On average, 75% of total shares outstanding are owned by institutional investors (similar to Di Giuli and Kostovetsky (2014)).

Panels B and C of Table 1 show the transition probabilities for CSR and CSiR, accumulated by an average firm-year for each. The last row and column include the probability of having a score of 4 or more. Overall, the tables suggests that there is considerable persistence in the scores obtained by the firms each year, which is evidenced by the diagonal probabilities. For instance, for companies that possess 0 CSR in a given year, the probability of having the same score the next year is 86%, while the probability of obtaining 1 point is 11%, and the probability of obtaining 2 points is 2.5%. More than half of our firms have a zero or one CSR score, 13% have 2, 7.6% have 3, and the remaining 17% of firms have 4 or more. A similar pattern is observed for CSiR. These values support using a Poisson model to estimate the effect of monitoring by institutional investors on CSR and CSiR.

1.2.3 Empirical framework

Institutional investors do not randomly select the firms they invest in or the monitoring intensity they assign to portfolio firms. More likely, they might choose their portfolio holdings and monitoring based on observable and unobservable firm characteristics. To address endogeneity, we will exploit variation in the attention that a firm receives from its institutional investors following Kempf et al. (2017).[10] Several recent papers show that institutional investors possess limited attention when performing their monitoring activities across their portfolio of investments (Kempf et al., 2017;

[10]In robustness tests, we exploit variation in the the proportion of shares held in a given firm (Appel et al., 2016; Crane et al., 2016).

Ben-Rephael et al., 2017a; Liu et al., 2017). This attention or monitoring intensity changes over time and depends on its net benefits. Kempf et al. (2017) show that when monitoring intensity is low (distraction is high), managers engage in value-destroying acquisitions and perform option backdating. Moreover, when institutional investors are distracted, boards of directors also relax their monitoring duties: independent directors attend fewer board meetings, and CEO compensation and accrual-based earnings management increase (Liu et al., 2017). This reduced institutional investor monitoring appears to lead to lower board oversight and higher agency costs for shareholders. Ben-Rephael et al. (2017a) document that institutional investor attention is key in easing the incorporation of new information into stock prices.

To study institutional investor distraction, we employ the data provided by Kempf et al. (2017).[11] In their paper, the authors create a firm-specific, time-varying measure of institutional investors' distraction that exploits shocks to different parts of their investment portfolio. Specifically, the authors use extreme returns in unrelated parts of institutional investors portfolios to identify periods during which shareholders direct their attention away from the firm. The authors weight the exposure that an institutional investor has to the attention-grabbing industry. Finally, they aggregate the weighted shocks along the firm dimension while considering the share of all institutional investors present in the firm. This gives a measure of how distracted the institutional investors of a given firm are in a given quarter. The following equation represents their measure:

$$D_{iq} = \sum_{f \in S_i} \sum_{J \neq J_i} w_{fiq-1} \times w^J_{fq-1} \times IS^J_q$$

where D_{iq} is the quarter-firm measure of shareholder distraction, w_{fiq-1} is the weight of each institutional investor j in firm i and quarter $q-1$, w^J_{fq-1} is the weight of industry J in the portfolio of institutional investor f at time $q-1$, and IS^J_q is a dummy variable that takes value one whenever industry J at time q receives a shock, which is defined as extreme returns in their main analysis. We create the annual measure of shareholder distraction from the quarterly variable provided by Kempf et al. (2017). First, we replace with zeros the quarter with missing values and then averaged it at the annual level.

[11] We thank Elisabeth Kempf and co-authors for making available their data on shareholder distraction.

In their original measure, Kempf et al. (2017) define as missing values those firm-quarters in which the firm belongs to an extreme-return industry.[12] We are confident that the distraction measure derived in Kempf et al. (2017) is plausibly exogenous, as no firm can control extreme industry price movements or the exposure of their shareholder base to such industries.

Thus, we proceed to estimate the following equation:

$$E(Y_{it}|X_{it}, \tau_t) = exp(\alpha_1 Distraction_{it} + \beta_1 X_{it} + \tau_t \times \phi_j) \tag{1.1}$$

where Y_{it} is CSR_{it} or $CSiR_{it}$, and $Distraction_{it}$ is the measure explained above.[13] X_{it} are known determinants of CS(i)R that have been previously considered in the literature: firm size (Firm_size), profitability (ROA), book-to-market (BM), research and development (RD), leverage (Lev), and governance (Gov_S and Gov_C) (Adhikari, 2016; Neubaum and Zahra, 2006; Johnson and Greening, 1999).[14] $\tau_t \times \phi_j$ are year times industry fixed effects, which allows to compare firms within the same industry at the same time. Standard errors are clustered at the firm level in all regressions.

1.3 Results

1.3.1 Institutional investor distraction, CSR and CSiR

The results from estimating Equation 1.1 are presented in Table 2. In column (1) of Panel A we analyze the impact of distraction on the overall measure of CSR. The coefficient in Column (1) is positive and statistically significant at the 1% level. This implies that an increase in the level of institutional investor distraction has a positive impact on the probability of obtaining an extra CSR strength. The economic impact is also large: a 1% increase in the distraction measure increases CSR by 1.76%.[15] In other words, a 1% increase in institutional investor distraction raises, by almost 2%, the probability of

[12] In untabulated results we find that the findings are robust to excluding firm years in which the firm belong to an extreme-return industry at least in one quarter, or to averaging quarterly observations across non-missing values.

[13] In our main tests, we regress CSR and CSiR on distraction, contemporaneously. However, in Section 1.4.3 we show that the results are robust to measuring the dependent variables in $t + 1$.

[14] Table 1 provides variables definitions.

[15] We obtain this economic magnitude by estimating the elasticity of CSR to investor distraction.

consistently giving more than 1.5% of earnings to charity or doing at least 5% of subcontracting with women- and/or minority-owned businesses. As noted by Hong and Liskovich (2014), obtaining an extra point on the MSCI ESG score could be very costly, as it might require having a well-funded pension plan or giving 5% of net earnings to charity. We conclude that, on average, when shareholders reduce their monitoring intensity CSR increases. In the rest of the Panel we explore the effect of a loosening of monitoring attention on the different components of CSR: community, diversity, employee relations, environment and product (number of strengths in each of the aforementioned categories). The estimates suggest that lower monitoring leads to higher CSR in almost all the dimensions. Interestingly, the coefficient is not statistically significant for product. Servaes and Tamayo (2013) and Adhikari (2016) argue that this dimension might have strategic implications, which might explain why it is not sensitive to CEO discretion.[16]

In Panel B of Table 2 we present evidence on the effect of institutional investors distraction on the overall proxy for CSiR and its individual dimensions. In column (1) we show that does not seem to be a significant effect of distraction on CSiR, on average.[17] In the rest of the table we show that this is partly due to the aggregation of different dimensions into one variable. In particular, the results suggest that a lower monitoring intensity increases concerns regarding the environment and product dimensions. In other words, an increase in institutional investor distraction increases the probability of paying substantial fines or civil penalties for waste management violations or product safety. This result is consistent with McCahery et al. (2016) which finds that one of the main triggers of institutional investors engagement is "Socially irresponsible corporate misbehavior." The results are not significant for community, employee relations and diversity. It could be that either some of them are not very important from the institutional investor perspective or that managers are vigilant on some issues even in the absence of an external monitor.

[16]According to MSCI ESG, the strengths in the product category are the following: quality (the company has a long-term, well-developed, company-wide quality program), R&D innovation (the company is a leader in its industry for R&D), benefits to economically disadvantaged (the firm has as part of its mission the provision of products for the economically disadvantaged), and other (the firm's products have notable social benefits that are highly unusual for its industry).

[17]In Section 1.4.3 we explore the impact of distraction on CSiR at $t+1$ and find a positive and significant effect at the 5% level.

The results presented in Panel A of Table 2 are consistent with those presented by Masulis and Reza (2015), Di Giuli and Kostovetsky (2014) and Adhikari (2016). Masulis and Reza (2015) show that when the tax saving created by corporate giving decreases, dividends are increased. Di Giuli and Kostovetsky (2014) find that *"increases in firm CSR ratings are associated with negative future stock returns and declines in firm ROA, suggesting that any benefits to stakeholders from social responsibility come at the direct expense of firm value"*. Then, institutional investors that hold a stake in the firm and have incentives to monitor the manager (Almazan et al., 2005; Appel et al., 2016; Chen et al., 2007) reduce CSR because this type of expenditure destroys value. In a similar vein, Adhikari (2016) finds that firms increase CSR when analyst coverage decreases. The mechanism is straightforward: reduced scrutiny by market participants allows managers to spend corporate resources on pet projects that do not have a direct link to firm value. By contrast, the results presented in Panel B show that distraction leads to an increase in corporate controversies. This is consistent with Krüger (2015) and Chatterji et al. (2009) that provide evidence on the negative shareholder reaction to social and environmental controversies, and the ability of controversies to predict future performance.

1.3.2 Pure monitoring and advising

Recent survey evidence suggests that institutional investors actively engage with management (McCahery et al., 2016). This engagement might be intended to reduce agency costs (e.g., Bushee, 1998; Aghion et al., 2013; Appel et al., 2016), or to bring expertise and advising to help managers make better decisions (e.g., Lerner, 1995; Casamatta, 2003; Repullo and Suarez, 2004). The implications from the *pure monitoring* and the *advisory* roles are, however, distinct. While the former is expected when agency costs are higher, the latter are more likely when the managerial team has lower experience. In this section we analyze these alternative roles of institutional investors on CSR and CSiR.

Previous literature documents that CEO power increases with CEO tenure (e.g., Graham, Kim, and Leary, 2017). On the one hand, powerful (long-tenured) CEOs are more likely to extract private benefits, and institutional investors can act as watchdogs to reduce agency costs. On the other hand, newly appointed CEOs are more likely to need external advising and expertise to successfully run the firm. In other words, we expect institutional

investors to act as pure monitors (advisors) in firms in which the executives have high tenure (low tenure). To explore these alternative roles, we sort firm-years in which the CEO Tenure is below and above the median of the sample.[18] In Panels A and B of Table 3, we examine these alternative roles of institutional investors for CSR and CSiR (and their components), respectively.

Columns (1) and (2) of Panel A present the effect of institutional investor distraction on CSR when advising and pure monitoring, respectively, are more likely to occur. The results show that distraction matters when firms have powerful (long-tenured) CEOs that are more likely to take advantage of the loosening of monitoring intensity to pursue some personal projects that do not necessarily create value. Same conclusions hold when analyzing the components of CSR (see columns (3) to (12) of Panel A). In particular, diversity, employee relations and environment increase when shareholders are distracted in firms more prone to agency costs, but in general (except for diversity) distraction has no significant effect on firm with less powerful CEOs. This result is in line with Kempf et al. (2017) and Liu et al. (2017), who show that managers and boards of directors exploit institutional investor distraction to conduct value-destroying activities, such as diversifying acquisitions and options backdating. Overall, it seems that the current levels of CSR activities, which are intended to improve the relationship between the firm and its stakeholders, are partly due to agency conflicts and represent a loss of shareholder value. Similarly, Davidson et al. (2016), document that CEO fixed effects account for more than 50% of the variation in CSR score, which is evidence of CEOs exerting their preferences when defining social and environmental policies. Notice that there is no significant effect on product-related issues, which is not surprising given that this dimension is related to strategic decisions of the firm rather than a voluntary action intended to improve stakeholders wellbeing (Adhikari, 2016).

Columns (1) and (2) of Panel B show the effect of institutional investor distraction on CSiR when advising and pure monitoring, respectively, are more likely to occur. The results show that shareholder distraction is relevant when advising is more necessary, but it is insignificant at conventional levels. However, the results are consistent with institutional investors providing expertise when analyzing the different dimensions of CSiR, at least for some of

[18]The median is 5 years (see Table 1). We drop firm-years in which we have more than one CEO (because of CEO turnover).

them. In particular, the results presented in columns (3) to (12) show that shareholder distraction matter for environment and product dimensions.[19] Interestingly, the results are insignificant for long-tenured CEOs. Overall, the results suggest that reducing CSiR might be value-enhancing, and that institutional investor can play a role by advising their investee companies on these issues.

In Table 4 we show that the results are robust to using alternative setting in which agency conflicts and the need for advise are more likely to occur. In Panel A we analyze the effect of institutional investor distraction on CSR in firms with high and low free cash flows. Consistent with agency problems being partly responsible for CSR, we find that distraction matters only when free cash flows are high. Notice that the product dimension remains unaffected by distraction regardless of the potential for agency problems. Finally, in Panel B we examine the impact of distraction on CSiR for high and low levels of board tenure. We argue that when board tenure is low, the need for external advising is greater. In column (1) we show that when firms receive higher attention by their institutional investors overall CSiR falls when the external advising is necessary, but it is unaffected when firms can rely on internal advising (high-tenure average board members). To sum up, the evidence presented in this section provide support for the pure monitoring and advising role of institutional investors, which constrain costly CSR activities, and promotes value enhancing policies that reduce CSiR.

1.4 Robustness checks

1.4.1 Alternative definition of institutional investor monitoring

As a robustness to institutional investor monitoring intensity we exploit variation in institutional investors ownership. Because institutional investors are sophisticated and have incentives to monitor managers, we assume that the larger the fraction they own, the tighter the monitoring will be. Following Appel et al. (2016), we exploit exogenous variation in the proportion of shares held by these investors due to their inclusion in the Russell 2000 Index. The intuition behind the instrument is the following. Institutional

[19]For the employee relations dimension, the results are significant at the 12% level only.

investors are often benchmarked against an index, and they hold shares of index constituents based on the weights that each stock has in the index. The Russell 1000 and Russell 2000 are two widely used benchmarks, and comparable amounts of money are invested in each of them (Chang et al., 2015). While the former comprises the largest 1000 stocks in terms of market capitalization, the latter includes the next 2000 stocks. Because the indexes are value weighted, the weight assigned to a stock in the bottom of the Russell 1000 is smaller than the weight of a stock in a top position in the Russell 2000.[20] We exploit the fact that because of this benchmarking, some variation in institutional ownership is exogenously determined. The identifying assumption is that firms very close to the threshold are similar except for institutional ownership and market capitalization. Using a fuzzy regression discontinuity, we instrument institutional ownership by inclusion in the Russell 2000, controlling for different polynomial orders of market capitalization (Appel et al., 2016). In the second-stage estimation, we use the predicted value of institutional ownership.[21]

Column (1) of Table 5 shows that firms that belong to the top positions of the Russell 2000 have 13% higher institutional ownership on average than firms that belong to the bottom positions of the Russell 1000, controlling for market capitalization and float.[22] In Column (2) we separately consider Quasi-Indexers (Bushee, 1998, 2001) because they are the institutional investors that react the most to the instrument.[23] Columns (3) and (4) show

[20]For instance, in June 2006, Burger King Holdings, Inc. was one of the smallest stocks in the Russell 1000 and received an index weight of 0.0031%, whereas JetBlue Airways Corp. ranked among the top positions of the Russell 2000 with a weight of 0.165%. Then, for every million dollars invested in each index, an institutional investor benchmarked against the Russell 1000 will invest $31 in Burger King Holdings, while one benchmarked against the Russell 2000 will invest $1650 in JetBlue Airways Corp.

[21]This alternative empirical strategy has a smaller sample size. The sample is restricted to the stocks around the Russel 1000/2000 threshold between 2004 and 2006. We start in 2004 because this is the first year that Russell provides us with their proprietary data, and we finish in 2006 because Russell changed its methodology for index assignment in 2007 and the IV strategy is not valid thereafter.

[22]For brevity, we only present the results for a 500 bandwidth, but results are qualitatively the same when using a 250 bandwidth.

[23]The identification strategy assumes that institutional investors benchmarked against the Russell indexes are those that invest in proportion to market capitalization. In Bushee's classification, Quasi-Indexers are the closest to this definition. Dedicated Investors invest only in a few stocks and are more likely to cherry pick them. Finally, Transient Institutional Investors, although highly diversified, maintain their holdings for

that institutional investors reduce CSR, and the results are economically and statistically significant at the 1% level. In particular, the elasticity is 1.13, suggesting that a 1% increase in institutional ownership reduces the probability of improving CSR by 1.13%. Columns (5) and (6) show that institutional investors reduce CSiR, and the results are economically and statistically significant at the 1% level. In particular, a 1% increase in institutional ownership reduces the probability of having an additional concern by 0.77%. In other words, an exogenous increase in institutional ownership decreases the probability of being involved in major tax disputes, or having major health and safety controversies. CSiR could entail large fines or penalties (including reputational costs) that drain cash out of firms and reduce value. Institutional investors with a sufficiently large stake in the firm have the incentives to monitor and advise firms regarding tax, environmental and other controversial issues.

In Table 6, we further explore the components of CSR (Panel A) and CSiR (Panel B). We present the instrumented results for Quasi-Indexers, which are the drivers of the effect, but the results are qualitatively similar when using all institutional investors (available upon request). Consistent with Table 2, the community, diversity and employee dimensions are reduced when monitoring is tightened. Interestingly, the estimate for the product dimension is not statistically significant, as the items considered in the MSCI ESG database are more likely to be related to strategic firm decisions (Adhikari, 2016). In line with this argument, Panel B shows that higher monitoring reduces product concerns (column (5)). Moreover, we also find a statistically significant decrease in the environmental and employee dimensions of CSiR. Overall, the results are consistent with Table 2, although not all dimensions show the same significance along the panels. This is not surprising, however, since this alternative identification strategy affects different types of institutional investors and use different time periods. This reduces concerns regarding the external validity of the previous setting. Moreover, the sample size varies in these tests and, in particular, is much smaller in this second test. Therefore, the results are not specific to a given time frame, to local average treatment effect induced by the instrumental variable, or by the definition of monitoring intensity used in the benchmark results.

The results presented above contradict previous works analyzing the effect of institutional ownership on CSR in the United States (Johnson and

a short period of time, which is not consistent with benchmarking against an index.

Greening, 1999; Neubaum and Zahra, 2006). Overall, previous studies share similar empirical characteristics, such as the use of a cross-sectional sample. They do not account for reverse causality or omitted variables, which are likely to generate biased estimations. These issues may partially account for the confounding results found in the literature and the differences between those findings and the results presented in this paper. Nonetheless, Dyck et al. (2018) provides causal evidence on the opposite effect for non-US countries.

1.4.2 Alternative proxy for CSR

In this subsection we evaluate our main analysis using Thomson Reuters' ESG Scores as an alternative CSR measure to MSCI ESG. Thomson Reuters ESG Scores cover more than 6000 firms globally since 2002. In the US, the databse covers firms quoted in the Russell 1000.[24] Thomson Reuters gathers public information and company-reported data to calculate industry-benchmarked percentile based scores on three main pillars: environmental, social and governance. The database provides an aggregated score for the three pillars (ESG score) and one with an overlay of ESG controversies (similar to MSCI ESG concerns, known as ESG Combined score). The ESG score is grouped into 10 categories: resource use, emissions, environmental innovation, workforce, human rights, community, product responsibility, management, shareholders and CSR strategy. We only make use of the first seven categories as we do not introduce governance items in our previous analyses (Di Giuli and Kostovetsky, 2014; Adhikari, 2016). Consistent with our main measure of CSR we drop the human rights dimension. The first 3 categories fall under the environmental pillar, and the next 4 under the social one, with the rest belonging to the governance pillar. We create an aggregated measure of CSR from the social and environmental pillars (E&S), which is the average score of 6 categories, as well as the individual scores for each categories under the social and environmental pillars.

We proceed to analyze the impact of instiutional investor distraction on the level of E&S, resource use, emissions, environmental innovation, workforce, community, and product responsibility. Table 7 shows the results of regressing Thomson Reuters ESG scores on institutional investor distraction

[24]Since Thomson Reuters ESG Scores are only available for firms quoted in the Russell 1000 we cannot apply the alternative empirical strategy that relies on the mechanical break in insitutional ownership around the Russell 1000/2000 indexes.

and a set of controls. In column (1), we report the impact of distraction on the aggregate measure of social and environmental scores. This impact is positive and statistically significant, which is consistent with our previous analysis presented in Table 2 Panel A. Institutional investor distraction seems to have a positive impact on resource use, emissions reduction, workforce and community, which is also consistent with the evidence provided in Table 2 Panel A. There is a notable effect from Table 7, where institutional investor distractions appears to lead to lower environmental innovation scores (column (4)). Inspecting the environmental innovation category more closely, we document that this dimension relates to the creation of environmental processes, technologies and products, which links to the product dimension in MSCI ESG. We show that the product dimension in MSCI ESG is different from other dimensions included in our benchmark measure of CSR (MSCI ESG strengths), as distraction does not lead to increases in such dimension. We find the same pattern in the product responsibility dimension of Thomson Reuters ESG scores (Table 7 column (7)), investor distraction does not lead to significant changes in the product score. Overall, these results strengthen our claim that institutional investor monitoring matters for CSR, and that CSR seems to stem from an agency conflict between shareholders and managers.[25]

1.4.3 Timing of CSR and CSiR

Previously, we show that when institutional investors are distracted, both CSR and CSiR increase. However, some concerns might remain regarding the timing of the dependent variable. In particular, the consequences of shareholder distraction might arise with some lag, as it may take time until the actions materialize. Consequently, we might be capturing the effect of distraction at the beginning of the year. To deal with this issue, some previous papers measure CSR (and CSiR) in the following year $(t + 1)$ (see for instance, Adhikari, 2016). In Table 8 we show that the main results of this paper remain unchanged when we measure CSR and CSiR in the following

[25]In untabulated results, we study the impact of insitutional investor distraction on CSR measured through Thomson Reuters ESG scores for subsamples where agency conflicts are more likely to take place. In a similar fashion to Table 3 Panel A and Table 4 Panel A, we find that distraction leads to increases in CSR only in subsamples where CEOs' possess a large tenure or free cash flows are high.

year, and in the latter, results are even statistically stronger.[26] Moreover, in untabulated results we find that an exogenous increase in institutional investor ownership decreases both CSR and CSiR in $t + 1$, consistent with the results presented in Table 5.

1.5 Mechanism

There are essentially two mechanisms through which institutional investors can affect corporate policies: exit and voice (Hirschman, 1970).[27] The exit option could be particularly costly when the investor's stake in the firm is large, and it is almost unfeasible for index trackers, as leaving a firm would increase the tracking error. In general, the anecdotal and empirical evidence from analyses of corporate governance suggests that voice is the preferred mechanism through which institutional investors communicate their concerns to management. For instance, Glenn Booraem, principal in Fund Financial Services and controller of the Vanguard funds, acknowledges his active involvement in hundreds of direct discussions with management every year. In a recent paper, McCahery et al. (2016) survey institutional investors regarding their preferences and actions concerning corporate governance. They show that institutional investors prefer to use *voice* over *exit* and that they prefer direct engagement with management to voice expressed through shareholder proposals. In addition, they find that those institutional investors that behave as active owners are those with a long-term stake in the firm. Similarly, Hoepner et al. (2016) provide anecdotal evidence of institutional investors engaging primarily through non-public channels when they target a company to change environmental, social and governance issues.

Carleton, Nelson, and Weisbach (1998) show that pension funds such as TIAA-CREF and CalPERS follow a negotiation process with the firms in which they invest. Typically, they contact managers to request a meeting to reach an agreement before filing or voting on a proposal. Similarly, Del Guercio and Hawkins (1999) find that passively managed funds might

[26]The drop in the number of observations is because we lose one year. As explained in Section 1.2.2, in 2011 MSCI ESG changed the methodology, and we cannot use that year in our regressions.

[27]Some papers suggest that the two mechanisms are not mutually exclusive but can be used as substitutes (see, for instance, Hirschman, 1970; Edmans and Manso, 2011; Dasgupta and Piacentino, 2015).

prefer direct communication with management and use the threat of public action (through shareholder proposals) as leverage in the negotiation process. Similarly, Appel et al. (2016) support *voice* as the mechanism through which passive investors influence corporate governance. In particular, they find that ownership by passive funds increases support (the average percentage of shareholders' votes) for governance-related shareholder proposals.

The mechanisms through which institutional investors affect CSR and CSiR have received less attention in the literature. One exception is the paper by Flammer (2015), in which the author finds that social and environmental proposals do not receive much support at annual meetings: approximately 75% of them receive less than 20% of votes in favor. She suggests that these proposals are symbolic in nature and argues that shareholders submit them to bring social issues to the attention of management and the public. In addition, shareholder proposals are not binding, that is, even if they were approved at the annual meeting, this does not mean that management would implement them.

To asses whether institutional investors exercise voice, we estimate Equation 1.1 with the dependent variable defined as the number of proposals submitted at shareholder meetings.[28] According to rule 14a-8, proposals need to be submitted at least 120 calendar days before the proxy statement release prior to the current annual meeting date. For this reason, and following Kempf et al. (2017), we averaged the quarterly distraction measure over the four quarters before the annual meeting. Table 9 presents the results using the exogenous change in monitoring intensity due to institutional investors distraction. In the first two columns the dependent variable is the number of governance proposals submitted at shareholder meetings. Consistent with Kempf et al. (2017), we find that when institutional investors are distracted, they submit less governance proposals at annual meetings. However, that is not the case for social and environmental proposals. Column (3) shows that the number of this type of proposals submitted by institutional investors increases, but it is not statistically significant at conventional levels. In column (4) we show that there is no effect for other investors. One can conclude that institutional investor distraction does not affect the likelihood of submitting an environmental and social proposal at the shareholder meeting. One potential explanation for this finding is that the type of institution that submits

[28]Notice that these proposals do not coincide with the dimensions measured by MSCI ESG and used as proxies for CS(i)R in the previous tests.

such kind of proposals is not distracted. The types of institutions that submit social and environmental proposals at shareholder meetings are socially responsible funds (SRI funds) such as Domini Social Investments, Calvert Asset Management, and the Interfaith Center for Corporate Responsibility (ICCR). The objectives of this type of investor may go beyond assuring a financial return on their investment, and they may also take advantage of other institutional investor distraction to pursue their own goals. As anecdotal evidence we show in Table 9 column (5) that the probability of ICCR submitting a social and environmental proposal at the annual meeting increases in institutional investors distraction.

We cannot exclude the possibility that some institutional investors seek to affect social and environmental policies using alternative mechanisms such as *exit* and direct communication with management. There is some anecdotal evidence suggesting that they might sometimes use these channels. For instance, in 2006, TIAA-CREF sold more than US$50 million of Coca-Cola stock due to concerns about CSR issues, after KLD removed the firm from its Broad Market Social Index. In response, Mr. Preisinger, Assistant Vice President and Senior Director of Shareholder Affairs, sent a letter to shareholders in which he acknowledges that they *"are in active dialogue with many of you"*. Regarding direct communication, a report on environmental sustainability proposals argues that firms and investors seek dialog on environmental and social issues (EY, 2012). Analyzing tax-planning activities, Bird and Karolyi (2017) show that institutional investors encourage these activities, particularly in those firms with higher effective tax rate and lower governance. They argue that governance activities may involve *complex discussions of tax strategy with management*, or identifying unused tax credits, suggesting that direct communication with management is a potential channel through which institutional investors shape corporate policies.

1.6 Conclusions

At present, the social and environmental policy of a firm, which spans a wide range of social and environmental activities, is considered a fundamental part of corporate management. However, there is not consistent evidence of how instiutional investor monitoring shape these corporate policies. In this paper, we provide empirical evidence consistent with institutional investor attention reducing both CSR and CSiR. Under the assumption that institutional in-

vestors have the proper incentives and ability to monitor top management, we find that an increase in institutional investor distraction substantially increases the probability of improving CSR scores and increases the probability of suffering from social and environmental controversies that damage firm value. These results are robust to different measures of monitoring intensity and CSR.

We further investigate settings in which institutional investors act as pure monitors or as external advisors to top management team. We find that distraction matters for CSR in setting prone to agency conflicts (high CEO power and high free cash flows). This is consistent with prior evidence that CSR is an agency cost (see for instance, Hong et al., 2012; Masulis and Reza, 2015; Adhikari, 2016). Meanwhile, we give evidence that distraction matters for CSiR in instances where managerial experience is low (short-tenured CEO) or the lack of internal advising (low board tenure).

Finally, we show distraction does not seem to affect the number of social and environmental proposals submitted at shareholder meetings. Additionally, we provide anecdotal evidence that there could be some shareholders taking advantage of institutional investors distraction to pursue their own agendas and increase social and environmental proposals.

Table 1: Descriptive statistics

Panel A: Summary statistics

	Obs	Mean	S.D.	P25	P50	P75
CSR	9243	1.655	2.43	0.00	1.00	2.00
CSiR	9243	1.738	1.78	1.00	1.00	2.00
Distraction	9243	0.134	0.05	0.10	0.14	0.17
IO	9243	0.750	0.22	0.62	0.78	0.90
Top5-share	9243	0.285	0.10	0.21	0.28	0.34
Firm_size	9243	7.870	1.59	6.72	7.67	8.79
ROA	9243	0.141	0.13	0.07	0.13	0.21
BM	9243	0.478	0.34	0.26	0.41	0.61
RD	9243	0.029	0.06	0.00	0.00	0.03
Lev	9243	0.218	0.19	0.05	0.19	0.32
Gov_S	9243	0.159	0.39	0.00	0.00	0.00
Gov_C	9243	0.529	0.65	0.00	0.00	1.00
SRI Proposals	2077	0.900	1.35	0.00	1.00	1.00
CEO Tenure	6651	7.540	7.19	3.00	5.00	10.00
Board Tenure	8778	9.180	3.62	6.56	8.68	11.22
FCF	8292	0.000	0.13	-0.04	0.00	0.05

This table provides sample statistics of the main variables used in the regression analysis. CSR is the number of strengths that a firm has in a given year. CSiR is the number of concerns that a firm has in a given year. Distraction is the annual average distraction measure of institutional investors from Kempf et al. (2017), where missing quarterly values have been replaced by zeros. IO is the proportion of shares owned by institutional investors. Top5-share is the fraction of shares owned by the five largest shareholders. Firm_size is the natural logarithm of total assets, and ROA is computed as operating income before depreciation and amortization divided by total assets at the beginning of the year. BM is the ratio of book-to-market value of equity. RD is expenditures on research and development normalized by total assets. Lev is leverage defined as the sum of short- and long-term debt divided by total assets. Gov_S and Gov_C are the overall MSCI ESG ratings of corporate governance strengths and concerns, respectively. S&E Proposals is the number of social and environmental proposals submitted at shareholder meetings. CEO Tenure is the total number of years during which an individual serves as a CEO. Board Tenure is the total average number of years during which board members except the CEO serve their role in the board. FCF is free cash flow calculated as the net cash flow from operations minus deferred taxes, interest paid, extraordinary items, net change in cash, plus net cash flow from investment, exchange rate effect, change in short-term debt, and divided by total assets. All control variables come from Compustat except for CEO Tenure and Board Tenure that come from Execucomp and BoardEx respectively. All controls are lagged in regressions and winsorized at the 1^{st} and 99^{th} percentiles.

Table 1: Descriptive statistics *(cont.)*

Panel B: Transition Matrix of CSR

CSR	0	1	2	3	4+	Total
0	85.83	10.76	2.45	0.59	0.37	100
1	13.97	70.18	10.89	2.78	2.18	100
2	6.15	11.28	62.79	12.29	7.49	100
3	2.62	4.12	11.8	57.87	23.6	100
4+	0.57	1.05	1.24	3.91	93.23	100
Total	38.63	23.14	12.9	7.61	17.72	100

Panel C: Transition Matrix of CSiR

CSiR	0	1	2	3	4+	Total
0	74.5	17.4	6.83	1.03	0.24	100
1	10.84	69.76	15.97	2.57	0.87	100
2	2.97	16.63	63.62	12.41	4.37	100
3	1.74	6.1	15.84	57.27	19.04	100
4+	0.43	1.49	3.4	9.36	85.32	100
Total	22.38	31.48	20.93	10.45	14.76	100

These panels shows CSR's (CSiR's) transition probabilities, after aggregating all instances of four or more strengths into a single category. Rows indicate the initial values of CSR (CSiR), and columns indicate final values. The diagonal values indicate the stickiness of CSR (CSiR). The bottom row indicates the total probabilities of having from 0 to 4 or more strengths or concerns.

Table 2: Institutional investor distraction, CSR and CSiR

Panel A: Institutional investor distraction and CSR

	CSR	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)	(6)
Distraction	14.81	20.04	12.79	16.89	23.54	3.05
	(3.83)	(2.29)	(2.85)	(3.32)	(3.21)	(0.27)
IO	0.08	-0.01	0.12	-0.05	0.52	-0.59
	(0.51)	(-0.02)	(0.61)	(-0.22)	(1.88)	(-1.21)
Top5-share	0.42	0.73	0.84	-0.38	-0.42	1.27
	(1.40)	(0.97)	(2.51)	(-0.84)	(-0.87)	(1.47)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Firms	2153	2153	2153	2153	2153	2153
Observations	9243	9243	9243	9243	9243	9243

Panel B: Institutional investor distraction and CSiR

	CSiR	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)	(6)
Distraction	3.18	8.79	-4.74	1.00	11.98	20.04
	(1.30)	(1.09)	(-1.38)	(0.29)	(2.01)	(3.37)
IO	-0.30	-1.00	-0.20	-0.20	-0.46	0.13
	(-2.59)	(-2.49)	(-1.33)	(-1.25)	(-1.54)	(0.45)
Top5-share	0.54	0.98	-0.05	0.53	0.15	1.51
	(2.36)	(1.22)	(-0.15)	(1.86)	(0.28)	(3.24)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Firms	2153	2153	2153	2153	2153	2153
Observations	9243	9243	9243	9243	9243	9243

This table presents the effect of institutional investor distraction on CSR and CSiR, as well as their individual dimensions. Panel A shows the impact of institutional investor distraction on CSR and its individual dimensions. Panel B shows the impact of institutional investor distraction on CSiR and its individual dimensions. Controls include firm size, return on assets, leverage, book-to-market, research and development, governance strengths and concerns. All variables are defined in Table 1. All regressions include year times industry fixed effects. Robust standard errors are clustered at the firm level. t-statistics are reported below the coefficient estimates.

Table 3: The pure monitoring and advising roles of institutional investors

Panel A: Institutional investor distraction and CSR for low and high levels of CEO Tenure

	CSR		Community		Diversity		Employee		Environment		Product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distraction	9.73	18.01	19.26	-0.68	14.59	21.12	5.06	14.65	6.52	40.02	-8.73	-3.97
	(1.53)	(2.95)	(1.42)	(-0.05)	(1.89)	(2.76)	(0.64)	(1.82)	(0.65)	(3.39)	(-0.60)	(-0.21)
IO	-0.19	0.10	0.81	-0.49	-0.23	0.29	-0.50	-0.13	-0.17	0.63	-0.15	-1.16
	(-0.87)	(0.35)	(1.55)	(-0.78)	(-0.85)	(0.83)	(-1.45)	(-0.29)	(-0.39)	(1.39)	(-0.23)	(-1.50)
Top5-share	0.34	0.80	-0.77	1.38	1.05	1.04	-0.41	0.42	-0.47	0.16	0.73	0.50
	(0.88)	(1.80)	(-0.87)	(1.27)	(2.42)	(1.97)	(-0.64)	(0.61)	(-0.70)	(0.22)	(0.60)	(0.34)
CEO Tenure	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230

Panel B: Institutional investor distraction and CSiR for low and high levels of CEO Tenure

	CSiR		Community		Diversity		Employee		Environment		Product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distraction	6.80	-3.04	7.87	2.15	-10.57	-7.21	8.83	-3.97	16.79	9.41	20.94	8.00
	(1.58)	(-0.74)	(0.53)	(0.16)	(-1.53)	(-1.25)	(1.61)	(-0.63)	(1.84)	(0.91)	(2.33)	(0.90)
IO	-0.13	-0.33	-0.66	-0.49	-0.35	0.02	-0.07	-0.35	-0.35	-0.81	0.62	-0.25
	(-0.73)	(-1.78)	(-1.11)	(-0.66)	(-1.29)	(0.10)	(-0.30)	(-1.29)	(-0.86)	(-1.62)	(1.75)	(-0.63)
Top5-share	0.72	0.13	-0.04	0.63	0.65	-1.05	0.84	0.31	0.19	-0.41	1.09	1.87
	(2.18)	(0.33)	(-0.04)	(0.50)	(1.14)	(-2.27)	(2.14)	(0.60)	(0.28)	(-0.45)	(1.76)	(2.03)
CEO Tenure	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230	3,421	3,230

This table presents the effect of institutional investor distraction on CSR and CSiR, as well as their dimensions, when institutional investors are more likely to bring pure monitoring through high CEO Tenure (Panel A) and advising through low CEO Tenure (Panel B). Panel A shows the different impact of institutional investor distraction on CSR and its individual dimensions for a subset of firms with lower than the median CEO tenure (odd columns) and larger than the median CEO tenure (even columns). Panel B shows the different impact of institutional investor distraction on CSiR and its individual dimensions for a subset of firms with lower than the median CEO tenure (odd columns) and larger than the median CEO tenure (even columns). All variables are defined in Table 1. All regressions include year times industry fixed effects. Robust standard errors are clustered at the firm level. t-statistics are reported below the coefficient estimates.

Table 4: Robustness check for the pure monitoring and advising role of institutional investors

Panel A: Institutional investor distraction and CSR for low and high levels of Free Cash Flow

	CSR		Community		Diversity		Employee		Environment		Product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distraction	7.47	13.54	17.60	7.32	4.87	11.03	11.91	17.90	10.06	28.70	-1.26	2.06
	(1.10)	(3.00)	(1.30)	(0.65)	(0.63)	(2.05)	(1.48)	(2.56)	(0.86)	(3.44)	(-0.07)	(0.16)
IO	-0.01	0.05	-0.37	0.24	-0.10	0.21	0.41	-0.50	0.09	0.64	-0.41	-0.72
	(-0.07)	(0.26)	(-0.84)	(0.45)	(-0.37)	(0.89)	(1.24)	(-1.51)	(0.24)	(1.87)	(-0.57)	(-1.32)
Top5-share	0.49	0.35	0.34	0.79	1.34	0.55	-0.83	-0.03	-0.90	-0.31	1.85	0.43
	(1.23)	(0.89)	(0.36)	(0.82)	(3.06)	(1.25)	(-1.30)	(-0.05)	(-1.33)	(-0.53)	(1.48)	(0.42)
FCF	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,144	4,144	4,144	4,144	4,144	4,144	4,144	4,144	4,144	4,144	4,144	4,144

Panel B: Institutional investor distraction and CSiR for low and high levels of Board Tenure

	CSiR		Community		Diversity		Employee		Environment		Product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distraction	5.72	-0.08	2.73	22.73	-4.05	-6.48	6.60	-5.67	16.59	7.91	23.98	5.83
	(1.82)	(-0.02)	(0.25)	(1.86)	(-0.89)	(-1.19)	(1.51)	(-1.07)	(2.31)	(0.86)	(3.06)	(0.66)
IO	-0.24	-0.30	-0.76	-0.49	-0.36	0.07	-0.15	-0.31	-0.17	-0.90	0.45	-0.12
	(-1.62)	(-1.84)	(-1.37)	(-0.88)	(-1.87)	(0.31)	(-0.74)	(-1.33)	(-0.45)	(-2.17)	(1.38)	(-0.28)
Top5-share	0.53	0.24	1.17	-0.49	0.14	-0.52	0.48	0.58	-0.12	0.14	1.22	1.46
	(1.84)	(0.75)	(1.10)	(-0.44)	(0.34)	(-1.20)	(1.34)	(1.33)	(-0.20)	(0.19)	(2.45)	(1.98)
Board Tenure	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,357	4,375	4,357	4,375	4,357	4,375	4,357	4,375	4,357	4,375	4,357	4,375

This table presents the effect of institutional investor distraction on CSR and CSiR, as well as their dimensions, in other settings when institutional investors are more likely to bring pure monitoring through high Free Cash Flow (Panel A) and advising through low Board Tenure (Panel B). Panel A shows the different impact of institutional investor distraction on CSR and its individual dimensions for a subset of firms with lower than the median Free Cash Flow (odd columns) and larger than the median Free Cash Flow (even columns). Panel B shows the different impact of institutional investor distraction on CSiR and its individual dimensions for a subset of firms with lower than the median Board tenure (odd columns) and larger than the median Board tenure (even columns). All variables are defined in Table 1. All regressions include year times industry fixed effects. Robust standard errors are clustered at the firm level. t-statistics are reported below the coefficient estimates.

Table 5: The impact of monitoring intensity on CSR and CSiR: alternative empirical strategy

	IO	QIX	CSR		CSiR	
	(1)	(2)	(3)	(4)	(5)	(6)
Russell2000	0.134	0.118				
	(7.589)	(9.535)				
IO			-2.562		-1.585	
			(-4.164)		(-4.257)	
QIX				-3.054		-1.855
				(-4.297)		(-4.366)
Ln_MktCap	2.211	1.638	3.435	3.158	0.463	-0.039
	(2.972)	(3.270)	(0.765)	(0.698)	(0.117)	(-0.009)
Ln_MktCap2	-0.048	-0.037	-0.078	-0.078	-0.004	0.004
	(-2.713)	(-3.096)	(-0.745)	(-0.738)	(-0.040)	(0.038)
Ln_Float	-0.078	0.025	0.298	0.582	-0.088	0.096
	(-3.833)	(1.721)	(1.240)	(2.999)	(-0.904)	(1.137)
	1st stage	1st stage	2nd stage	2nd stage	2nd stage	2nd stage
Observations	2,835	2,835	2,835	2,835	2,146	2,146

This table presents the robustness to monitoring intensity. Columns (1) and (2) present the first-stage estimation of membership in the Russell 2000 and institutional ownership (IO) and Quasi-Indexer ownership (QIX), respectively, plus market capitalization polynomials and float controls. IO is the overall level of institutional ownership, while QIX are Quasi-Indexer investors (Bushee, 1998, 2001), which are more likely to be affected by the instrument. Russell2000 is a dummy variable equal to 1 if the firm belongs to the top positions of the Russell 2000. Ln_MktCap and Ln_Float are the natural logarithm of market capitalization and float provided by Russell, respectively. Standard errors are clustered at the firm level. Columns (3) and (4) report the second-stage estimation for the level of institutional and Quasi-Indexer ownership on CSR, respectively. Columns (5) and (6) present the second-stage estimation for the level of institutional and Quasi-Indexer ownership on CSiR, respectively. In columns (3) to (6) we use bootstrapped standard errors to account for possible prediction error in the first-stage estimation of institutional (and Quasi-Indexer) ownership. All regressions include year fixed effects. t-statistics are reported below the coefficient estimates.

Table 6: Dimensions of CSR and CSiR

Panel A: Institutional investor ownership and CSR dimensions

	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)
QIX	-5.840	-3.352	-1.883	-0.853	-3.548
	(-2.925)	(-4.939)	(-1.725)	(-0.362)	(-1.274)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2,835	2,835	2,835	2,835	2,835

Panel B: Institutional investor ownership and CSiR dimensions

	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)
QIX	-1.354	-0.644	-0.999	-3.689	-5.305
	(-0.797)	(-1.088)	(-1.658)	(-3.047)	(-5.070)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2,835	2,835	2,835	2,835	2,835

These tables report the second-stage estimation for the predicted level of institutional on CSR (Panel A) and CSiR (Panel B) for the different dimensions of the constructs: community, diversity, employee relations, environment and product. All regressions include year fixed effects. t-statistics are reported below the coefficient estimates.

Table 7: Alternative measure of CSR

	E&S	Res_Use	Emi_Red	Env_Inn	Work	Comm	Prod_Res
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Distraction	2.112	3.874	3.900	-2.319	3.437	2.759	1.020
	(2.286)	(2.699)	(2.734)	(-1.717)	(2.109)	(2.124)	(0.748)
IO	0.081	0.088	0.108	0.014	0.080	0.032	0.163
	(2.034)	(1.489)	(1.892)	(0.247)	(1.136)	(0.542)	(2.596)
Top5-share	-0.194	-0.209	-0.211	-0.252	-0.130	-0.105	-0.256
	(-2.848)	(-2.033)	(-2.093)	(-2.615)	(-1.048)	(-1.070)	(-2.094)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,660	2,660	2,660	2,660	2,660	2,660	2,660

This table presents the impact of institutional investor distraction on alternative measures of CSR. In column (1), the dependent variable is the Thomson Reuters ESG Score for the environmental and social dimensions, which does not include the governance dimension. Columns (2), (3), and (4) are the categories within the environmental dimension . These are Resource Use (column (2)), Emission Reduction score (column (3)), and environmental innovation (column (4)). Columns (5), (6), and (7) belong to the social dimension. These are Workforce (columns (5)), Community (column (6)), and Product Responsibility (column (7)). E&S is the defined as the aggregate score of the 6 environmental and social dimensions reported by Thomson Reuters ESG database (previously known as ASSET4). Resource Use (Res_Use) is defined as the performance of firms to reduce the use of energy, water or materials. Emission Reduction (Emi_Red) is defined as firms' environmental commitment and effectiveness to reduce their emissions in production and operational processes. Environmental Innovation (Env_Inn) is defined as creating new environmental technologies, processes, and products. Workforce (Work) is defined as firms' effectiveness towards job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce. Community (Comm) is defined as firms' commitment towards being a good citizen, protecting public health and respecting business ethics. Product Responsibility (Prod_Res) is defined as firms' capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy. All these definitions are obtained from Thomson Reuters ESG Scores methodology manual from November 2017. All regressions include industry times year fixed effects. t-statistics are reported below the coefficient estimates.

Table 8: Robustness to timing of CSR and CSiR

Panel A: CSR and its dimensions in $t+1$

	CSR	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)	(6)
Distraction	14.028	23.427	13.930	12.218	19.704	11.482
	(4.143)	(2.912)	(3.275)	(2.376)	(3.283)	(0.960)
IO	0.116	0.100	0.216	-0.030	0.348	-0.483
	(0.715)	(0.254)	(1.051)	(-0.117)	(1.246)	(-0.958)
Top5-share	0.437	0.506	0.807	-0.424	0.018	1.325
	(1.416)	(0.677)	(2.292)	(-0.889)	(0.036)	(1.496)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,465	7,465	7,465	7,465	7,465	7,465

Panel B: CSiR and its dimensions in $t+1$

	CSiR	Community	Diversity	Employee	Environment	Product
	(1)	(2)	(3)	(4)	(5)	(6)
Distraction	4.909	8.290	-2.815	-4.100	13.447	21.047
	(1.992)	(1.072)	(-0.818)	(-1.161)	(2.199)	(3.685)
IO	-0.240	-0.831	-0.173	-0.179	-0.385	0.307
	(-1.950)	(-1.921)	(-1.091)	(-1.033)	(-1.191)	(1.057)
Top5-share	0.431	0.762	0.003	0.478	-0.071	1.203
	(1.830)	(0.880)	(0.009)	(1.523)	(-0.126)	(2.477)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,465	7,465	7,465	7,465	7,465	7,465

These tables present the effect of shareholder distraction on CSR (Panel A) and CSiR (Panel B) for the total scores (column 1) and the different dimensions of the constructs in $t+1$: community, diversity, employee relations, environment and product (columns (2) to (6), respectively). The rest of the variables are defined in Table 1. All regressions include firm-specific controls and year times industry fixed effects. Standard errors are clustered at the firm level. t-statistics are reported below the coefficient estimates.

Table 9: Shareholder social and environmental proposals

	Gov Proposals		S&E Proposals		
	Institutions	Other	Institutions	Other	ICCR
	(1)	(2)	(3)	(4)	(5)
Distraction	-3.482	-0.999	1.652	-2.425	9.506
	(-2.542)	(-0.991)	(1.379)	(-1.193)	(1.776)
IO	0.499	-0.444	-0.110	-1.564	-2.816
	(1.329)	(-0.925)	(-0.328)	(-2.339)	(-2.216)
Top5	-0.337	1.661	-1.084	1.631	-0.650
	(-0.541)	(2.309)	(-1.607)	(1.247)	(-0.282)
Controls?	Yes	Yes	Yes	Yes	Yes
Observations	2,026	2,026	2,026	2,026	477

This table explores whether institutional investors use social and environmental proposals to shape CS(i)R policies. Columns (1) and (2) present the results of the impact of shareholder distraction on the number of governance proposals submitted at shareholder meetings by institutional investors and other shareholders, respectively. In columns (3) and (4) we show the results of the effect of shareholder distraction and the number of social and environmental proposals submitted at shareholder meetings by institutional investors and other shareholders, respectively. Finally, in column (5) we show the probability of submitting a social and environmental proposal by ICCR when institutional investors are distracted. Robust standard errors are clustered at the firm level. t-statistics are reported below the coefficient estimates.

Chapter 2

The bright side of stock repurchases

2.1 Introduction

American firms spend several millions of dollars in stock repurchases each quarter: between 2005 and 2014, S&P 500 firms distributed more than $3.95 trillion US dollars using this method (Fried and Wang, 2017), drawing criticism from politicians and academics. Hillary Clinton has claimed that firms are using too much money to repurchase shares and that they are nearly out of funds to *"build a new factory or research lab, or to train workers, or to give them a raise."*[1] Lazonick (2014) and Gutiérrez and Philippon (2016) also made similar claims. Almeida, Fos, and Kronlund (2016) conclude that managers are willing to shift away investment and employment towards stock repurchases that allow them to meet analysts' earnings per share (EPS) targets.[2] In contrast to this negative wave of opinion against repurchases,[3] in this paper I present evidence of actual repurchases increasing in-

[1] "Stocks buybacks draw scrutiny from politicians". The New York Times, August 10, 2015.

[2] In a previous paper, Bens, Nagar, and Wong (2002) make a similar argument analyzing the extensive use of employee stock options that induces firms to repurchase shares to avoid dilution of the EPS ratio when the options are exercised.

[3] This negative view is not fully justified as it is based on partial and misleading analyses that ignore the fact that investors can reinvest the cash in other firms that might have better investment opportunities (Edmans, 2017) or that in the presence of a global reduction in growth opportunities, firms will simultaneously increase stock repurchases and reduce investment which results in a positive correlation between repurchases and investment (Grullon and Michaely, 2004).

vestment in firms that suffer the most from asymmetric information and rely on external finance. This positive effect of stock repurchases on investment is consistent with a theory of firms using this payout form as a signal that allows them to access capital markets later in better terms.

It is well established that in the presence of informational asymmetries and no information transfer, market value must reflect the average firm quality (Akerlof, 1970; Leland and Pyle, 1977; Ofer and Thakor, 1987), meaning that good (bad) firms will be undervalued (overvalued). The credibility of actual repurchases as a signal comes from the fact that for bad firms repurchasing shares is too costly, as long-term investors would be diluted if manager engage in that kind of transaction. To the contrary, good-firm insiders benefit from actual repurchases when the firm is undervalued (Fried, 2014, 2015), what allows for a separating equilibrium.[4] The existence of informed shareholders with a long-term horizon seems a reasonable assumption in the average American publicly traded firm, for which Perez-Gonzalez (2002) and Holderness (2009) document high insider ownership.[5] In this signaling context, stock repurchases are expected to increase investment in firms suffering the most from asymmetric information, as that would allow them to convey their type to capital providers. The empirical results are consistent with this argument. In particular, the estimates indicate that for a typical increase in market-based asymmetric information, a one-standard-deviation increase in stock repurchases boosts investment by 10% (relative to the mean). However, stock repurchases are only expected to affect investment in those firms that rely on external capital markets to finance investment and, therefore, need to signal their type. Indeed, when I sort firms into external finance dependent (EFD) and those that are not reliant on external finance (No EFD), I find that the results are driven by the former.[6] Moreover, the effect is statistically equal to zero in the latter. In additional tests, I show that the results are not driven by firms simultaneously signaling through insider purchases or dividends.

To further support the causal interpretation of the results, I instrument repurchases using the exogenous price pressure created by distressed mutual funds (Coval and Stafford, 2007; Khan, Kogan, and Serafeim, 2012; Edmans, Goldstein, and Jiang, 2012). Coval and Stafford (2007) analyze the effect of forced sales by distressed mutual funds on equity markets and show that sales concentrated in a

[4]In Appendix A I provide the simplest model specification for which this result holds.

[5]Perez-Gonzalez (2002) reports that large individual shareholders hold 25% of the outstanding shares of the firms they participated in, while Holderness (2009) finds that 96% of US firms have blockholders, which own 39% in aggregate of the mean firm.

[6]EFDs are those firms that expect to have at least two quarters with financing deficits in the following year, where the quarterly financing deficit is estimated as in Frank and Goyal (2003).

limited number of securities significantly affect stock prices, resulting in transaction prices that deviate from fundamental values. The authors document ex post price reversals, which are inconsistent with information-based trading. In the same vein, Khan et al. (2012) use mutual fund flows to identify overvalued equity, and they find abnormal return reversion for (exogenously) overvalued stocks. Similarly, Edmans et al. (2012) construct a measure of undervaluation based on hypothetical trades and arrive at similar results. These papers show that this type of misvaluation is unrelated to firms' prospects, providing support for the exclusion restriction required by the instrumental variables approach.

In the first-stage estimation, I show that firms suffering from exogenous price pressures from distressed mutual funds are more likely to repurchase shares and, on average, increase repurchases relative to shares outstanding by 13.6%. Furthermore, I find that managers privately identify exogenous undervaluation and time insider purchases to exploit mispricing, a result consistent with Ali, Wei, and Zhou (2011) and Khan et al. (2012). In the second-stage estimation, I first show that stock repurchases motivated by mutual funds' fire sales neither increase nor decrease investment on average.[7] I further instrument the interaction between stock repurchases and information asymmetry, and the results confirm the panel fixed-effect results: stock repurchases increase investment, particularly in firms with higher information asymmetry, and the results are driven by EFD firms. In additional tests, I replace the firm-level variable for asymmetric information with the VIX index, which proxies for aggregate volatility in firms' market value (Kim and Kung, 2017).[8] The results hold, and in general are stronger, under the alternative proxy for asymmetric information, and this suggests that the market finds the signal more useful when overall uncertainty over firms' value is higher.

I also analyze the effect of stock repurchases on financing policies. On the one hand, if EFD firms repurchase shares to signal their type, they should be raising external financing in the following period. I find that stock repurchases are followed by debt issuance in the EFD subsample (but not for cash-rich firms). Moreover, I do not find changes in cash holding, thus reducing concerns that the firms with excess cash are the ones repurchasing shares and increasing investment. Regarding equity issuance, the results are inconclusive, but in general, I find no

[7]Importantly, the instrument used in this paper treats firms that are similar in observables to the average repurchaser in the population. Some recent papers have questioned whether instrumental variables have been useful in increasing the understanding of the causal effects, as the local effect identified by the instrument can be unrepresentative of the population treatment effect (Jiang, 2017).

[8]The validity of the instrument for the interaction (Rep*IA) relies on the assumption that Rep is the only endogenous variable in the model. This assumption is more likely true for the VIX, which is exogenous to individual firms.

significant changes in this source of financing. However, the results should be interpreted with caution because the instrument is very likely to violate the exclusion restriction for financing policies and, in particular, for equity issuance. Fire sales by distressed mutual funds depress stock prices, making it costlier for firms to raise funds through equity issuance. Interestingly, while Almeida et al. (2016) find that managers finance EPS-motivated repurchases with investment cuts and reductions in cash holdings, stock repurchases induced by exogenous price pressures increase debt issuance without changing the average cash holdings.

Finally, stock repurchases should allow good firms to borrow at a lower cost of capital if they can actually convey information to borrowers and investors. Using data on new debt issuance I document a negative association between stock repurchases and the at-issue yield spread on new debt issuance. Moreover, the association is increasing in asymmetric information. In addition, I find that firms that repurchase shares before seasoned equity offerings (SEOs) experience lower discounts in the [0,1] window around the announcement, which is consistent with Billett and Xue (2007) and Bond and Zhong (2016). The effect is stronger for firms that suffer the most from adverse selection, which is in line with the mechanism proposed in this paper. Similar to Ben-Rephael, Oded, and Wohl (2014), the results suggest that the market uses the information contained in repurchase activity.

In additional tests I analyze how the results change when I test the prediction in the subsample of firms in which managers or long-term insiders hold a significant fraction of the outstanding shares. I show that the results are stronger when I drop firms with negligible managerial ownership, or when firms are less likely to have informed (and long-term oriented) investors, as expected. Moreover, I analyze whether firms with short-term incentives contaminate the results, creating a downward bias of the estimates. The results are economically and statistically stronger when I drop firm-quarter in which firms are close to the zero EPS threshold. The latter results suggest that the firms that trade-off investment for stock repurchases that allow them to beat analysts forecasts (Almeida et al., 2016) are different from the firms using repurchases as a signaling tool.

This paper contributes to the existing literature in several directions. First, I contribute to the payout policy literature providing a new motive for actual repurchases, with distinct implications for investment. In a world with perfect capital markets, the value of the firm is independent of the financial structure and payout policy (Modigliani and Miller, 1958; Miller and Modigliani, 1961); therefore, repurchases should not affect investment. The traditional theories that explain payout policies are generally grouped according to the frictions in (i) taxes (e.g., Miller and Scholes, 1978), (ii) agency problems (e.g., Easterbrook, 1984; Jensen, 1986), and (iii) asymmetric information (Bhattacharya, 1979; John and

Williams, 1985; Miller and Rock, 1985; Ofer and Thakor, 1987; Constantinides and Grundy, 1989; Oded, 2005; Bhattacharya and Jacobsen, 2016).[9] I contribute to this vast literature arguing that repurchase may play an important signaling role that results in improved firms investment.

On the other hand, this paper contributes to the current debate on the real effect of stock repurchases. The extensive literature on payout policy in general and stock buybacks in particular (see Allen and Michaely, 2003; Farre-Mensa, Michaely, and Schmalz, 2014, for a comprehensive review), has generally left the real effects unaddressed, and if anything, it provides evidence of a negative association between stock repurchases and real outcomes (Grullon and Michaely, 2004; Bens et al., 2002), or a negative causal impact (Almeida et al., 2016). To the contrary, I provide causal evidence that repurchases increase investment, particularly in firms suffering from high information asymmetry, while I find no statistically significant effect on firms that suffer the least from this problem. Taken together, these results talk to the heterogeneity of stock repurchases, and have straightforward regulatory implications: banning stock repurchases would harm firms that use them to signal their type, while it would have beneficial effects for firms more likely to opportunistically use stock repurchases to meet market expectations. Consequently, a deeper understanding of the motivations for and real effects of stock repurchases is needed to weigh the pros and cons of this policy and determine its social cost.

Finally, this paper also adds to the recent literature suggesting that financing, payout, and investing decisions have to be analyzed in a unified framework (Bond and Zhong, 2016; Farre-Mensa, Michaely, and Schmalz, 2017). In a Myers and Majluf (1984) setting, stock repurchases would only make sense for firms with excess cash and without investment opportunities. However, Fama and French (2005) find that many firms with financing deficits repurchase shares. Similarly, Farre-Mensa et al. (2017) provide evidence of firms systematically using debt and equity to finance payouts. They find that approximately one-third of the aggregate capital paid out by American public firms is raised from the same payers during the same year via debt or equity issuance. Similar to Bond and Zhong (2016), this paper provides a rationale for why firms with financial deficit might engage in stock repurchases, violating the pecking order hypothesis.

[9]More recently, the literature provides alternative motives for payout in general and share repurchases in particular. These alternative explanations include managers repurchasing shares to increase EPS targets that affect their compensation (Hribar, Jenkins, and Johnson, 2006; Ben-Rephael et al., 2014; Almeida et al., 2016), to improve market liquidity (Hillert, Maug, and Obernberger, 2016), price informativeness (Busch and Obernberger, 2017), undervaluation and market timing (Ben-Rephael et al., 2014; Dittmar and Field, 2015), among other motives.

2.2 Hypothesis Development

The difficulty of distinguishing good from bad firms is inherent to capital markets. In the absence of a credible way of conveying information to actual and future stakeholders, good and bad firms will be traded at the average (or cross-sectional) value (Akerlof, 1970; Leland and Pyle, 1977; Ofer and Thakor, 1987).[10] In other words, the good firm would be undervalued, while the bad one will be overvalued. Undervaluation could be problematic for firms that need to access external capital markets to finance investment projects, because it means that in the absence of a signal, they have to borrow at a higher cost of capital. In this setting, actual repurchases can convey information to capital providers. The general argument is that good firms could repurchase shares to signal their type because bad firms will find it too costly to mimic. The reason is that, when they repurchase *expensive* shares, the stake of non-selling shareholders is diluted.[11] Consequently, if the manager interests are aligned to those of long-term shareholders, only good firms would repurchase shares in equilibrium. Moreover, where substantial asymmetric information exists and where the fraction of lemons is high relative to the proportion of good firms, markets might fail to exist (Akerlof, 1970; Leland and Pyle, 1977). Consequently, my first prediction is that actual repurchases should disproportionately help firms that suffer the most from adverse selection.[12]

Previous papers have suggested that stock repurchases can be used to signal firm type (e.g, Miller and Rock, 1985; Ofer and Thakor, 1987). What is different here is that I show that actual repurchases can lead to an increase rather than a decrease in investment. However, this will only be the case if firms need to access external capital markets to finance the projects. To put it differently, asymmetric information should not affect investment decisions if the firm already has the funds to finance profitable projects, and therefore, no systematic relationship between these variables is expected for cash rich firms. Then, the positive effect of actual repurchases on real outcomes is expected only for external finance dependent firms.

Finally, notice that a key assumption behind the mechanism is that managers have a stake in the firm, or that their interests are aligned to non-selling (long-term) shareholders. This seems reasonable in the average American publicly traded firm, for which Holderness (2009) documents high insider ownership. As in Leland and Pyle (1977), *managers actions speak louder than words*, and repurchasing shares when they have skin in the game, would signal that the firm is good

[10] That is, the weighted average of good and bad firms' market price under perfect information.

[11] Oded (2005) uses a similar mechanism to show that only good firms announce a repurchase program in equilibrium.

[12] In Appendix A I provide a very simple model to illustrate this idea.

(and it is undervalued) because they would otherwise be bearing the dilution costs themselves. Alternatively, if (informed) long-term investors hold a significant fraction of total shares outstanding, they would prevent managers from repurchasing overvalued shares, adding credibility to the signaling mechanism. To sum up, the results are expected to be stronger when managers or other informed investor own a sufficiently large portion of the firm.

2.3 Sample and Data

2.3.1 Sample Selection

The sample period covers 11 years, from 2004 to 2014. In 2003, the SEC increased the disclosure requirements for open market repurchases. In particular, since March 2004, firms have been required to report the total number of shares repurchased and the share price on a monthly basis on Form 10-Q and Form 10-K (Item 2(e) and Item 5(c), respectively). Therefore, to reduce measurement error in open market repurchases, I analyze the period from 2004 to 2014 for public firms incorporated in the United States. The main databases are Compustat for financial information and CRSP for stock returns. Following previous literature, I exclude financial firms (SIC 6000-6999), regulated utilities (SIC 4900-4999), and quasi-governmental and nonprofit firms (SIC 9000-9999). In addition, I exclude foreign private issuers because they do not have the same filing requirements, firm-quarters with a negative or missing value of assets and a market price below 1.

In Section 2.4.2, I address endogeneity using an instrumental variable approach. I collect data on mutual funds' holdings, returns and total net assets from the Thomson Reuters and CRSP Mutual Fund databases. In 2004, the SEC increased the disclosure frequency for mutual funds, from a semiannual to a quarterly basis. This meant an increase in the availability of information to estimate the proxy for downward price pressure.[13]

To test the main hypothesis, I need to identify EFD firms. I follow Frank and Goyal (2003) in creating the financing deficit variable, based on cash flow statement data. I drop some firms that do not report quarterly data to construct that main proxy.[14] Finally, the data for all variables are winsorized at the first

[13]Prior to 2004, many mutual funds voluntarily disclosed their holdings on a quarterly basis.

[14]The results are qualitatively similar when I keep those firms, but the estimations are noisier. The list of excluded firms and the results when including them are available upon request.

and ninty-ninth percentile.

2.3.2 Descriptive statistics

Table 1 presents the descriptive statistics for the main firm-level variables used in this paper (see Appendix B for a detailed description of their construction). The average firm repurchases shares in more than one-third of the quarters, and it spends 58 million US dollars on buybacks quarterly (conditional on Repurchases>0). This represents 1.6% of total assets and 1.1% of total shares outstanding. The average firm invests 1.3% of total assets in capital expenditures, 1.5% in R&D quarterly (and 2.7% in the sum of both). The mean firm has a market capitalization of 4.3 billion dollars. Institutional investors (mutual funds) account for 62% (20.5%) of total shares outstanding. These values are consistent with previous literature (Ben-Rephael et al., 2014; Almeida et al., 2016). In untabulated results, I find that firms that repurchase shares are significantly larger, more profitable, have higher cash flows, and pay more dividends than non-repurchasers. They also have higher institutional and mutual fund ownership. Importantly, repurchasers have lower investment opportunities, proxied by Tobin's Q, which could simultaneously increase stock repurchases and reduce investment (Grullon and Michaely, 2004) in the absence of a research design that addresses endogeneity.

2.4 Results

2.4.1 Panel regression

Panel regression methodology

In the main specification, I regress the change in investment in the following year on stock repurchases and the interaction with asymmetric information. Following Almeida et al. (2016), the dependent variables are measured as the difference between the mean investment in the following four quarters (relative to repurchases) compared with the mean of the previous four quarters, and the difference is normalized by total assets:

$$\triangle Investment_{it} = \alpha_1 Rep_{it} + \beta_1 Rep_{it} * AI_{it} + \delta_1 AI_{it} + \gamma_1 X_{it-1} + \eta_i + \theta_t + \epsilon_{it}, \quad (2.1)$$

where $Investment_{it}$ is either capital expenditures (CAPEX) or the sum of capital expenditures and research and development expenses (CAPEX + RD) (Baker,

Stein, and Wurgler, 2003; Grullon and Michaely, 2004).[15] $Repurchases_{it}$ is the quarterly number of shares repurchased, normalized by total shares outstanding at the beginning of the quarter. Following Leuz and Verrecchia (2000) my main proxy for asymmetric information is based on the bid ask spread normalized by the stock price. In particular, AI_{it} is a ranked variable based on the average quintile-ranked measure of the by the bid-ask spread, that varies from 0 (low) to 1 (high information asymmetry).[16] In line with the investment literature, I control for potential correlation with the firm's investment opportunities, measured by Tobin's Q and operating free cash flow (Baker et al., 2003; Rauh, 2006; Almeida et al., 2016; Kim and Kung, 2017). In the baseline tests, I also consider firm size, past returns (Hau and Lai, 2013), and leverage. All the controls are included in the control matrix, X_{it-1}, and they are measured as of the beginning-of-year t. θ_t are quarter-year fixed effects, and η_i are firm fixed effects.

The main coefficient of interest is β_1, and I expect it to be positive. According to the main prediction, firms facing high asymmetric information benefit the most from signaling because doing nothing would imply substantial cross-subsidization or market breakdown. In addition, I will analyze the average effect of stock repurchases, α_1 (excluding the interaction term and the proxy for asymmetric information), for which previous literature finds a negative association (Grullon and Michaely, 2004). I will show that this result vanishes after addressing endogeneity concerns.

The positive effect of stock repurchases on investment hypothesized in Section 2.2 does not necessarily hold for the average firm. If anything, the effect should be observed for firms that rely on capital markets to finance investment projects. Frank and Goyal (2003) document that external finance is much more frequent than is often recognized, and in many cases, it exceeds investment. I follow the authors in the construction of the financing deficit variable, from the cash flow identity:

$$DEF_{it} = DIV_{it} + I_{it} + \triangle WC_{it} - C_{it},$$

where DIV_{it} represents cash dividends, I_{it} is net investment, $\triangle WC_{it}$ is the change in working capital, and C_{it} is cash flow after interest and taxes. Then, I define a firm to be EFD if DEF_{it} is positive in at least two quarters in the following

[15] In what follows, all the dependent variables are in changes and identified using uppercase letters. The only exceptions are the cost of debt and equity analyzed in Section 2.5.2.

[16] I use a ranked variable to reduce measurement error and the effect of outliers. In addition, in Section 2.4.3, I use an alternative definition of asymmetric information, and using a ranked variable eases comparison.

year.[17] Notice that timing matters here. In particular, the repurchase activity is only disclosed in the 10-Q and 10-K filings, with deadlines 40-45 and 60-90 days after the quarter end, respectively. Therefore, contemporaneous repurchases would not be useful as a signal if the firm will eventually need to issue equity or debt to finance investment projects. The implicit assumption is that managers can anticipate that they will need to raise funds externally. I will show in the next section that the proxy provides a good sorting for firms that is consistent with Baker et al. (2003).

Panel regression results

Table 2 presents the association between stock repurchases and changes in investment. In Panel A, the dependent variable is CAPEX, while in Panel B, it is CAPEX + RD. Columns (1) and (2) provide evidence of a negative association between stock repurchases and changes in investment in the following year. In the first column, I control for growth opportunities (Q) and cash flow (CF) as in Almeida et al. (2016), while in the second column, I additionally control for firm size (Size), past return (Return) and leverage (Lev). I find a negative and statistically insignificant association in columns (1) and (2) of Panel A.[18] The relationship is stronger under the alternative definition of investment that includes research and development expenses. However, even after controlling for unobservable (time-invariant) firm characteristics, there might be some endogeneity issues. For instance, Grullon and Michaely (2004) argue that mature firms without good investment prospects simultaneously increase stock repurchases and cut investment. Indeed, using an instrumental variable approach, I will show in Section 2.4.2 that this seems to be the case.

Before moving to the exogenous variation in stock repurchases, I will make progress on causality by focusing on the theoretical mechanism through which stock repurchases would increase investment. In particular, stock repurchases can help overcome problems of adverse selection because they might be used to signal firm type, thereby reducing the cost of external funds. Thus, stock repurchases

[17]This is in the spirit of Rajan and Zingales (1998) and, to some extent, Baker et al. (2003). However, Rajan and Zingales use US industry data to define industry dependence on external finance around the world. Baker et al. (2003) use the Kaplan and Zingales index to define equity-dependent firms only. This index is not appropriate in the current setting because firms could also raise debt to finance a project.

[18]The results in Almeida et al. (2016) are both economically and statistically larger. The most likely explanation for the difference is that the authors do not include firm fixed effects in their estimation. In untabulated results, I find a similar coefficient and t-statistic after removing them. Moreover, they consider a different sample period and an alternative definition of stock repurchases.

should help firms that are severely affected by asymmetric information (and need to raise external funds to finance profitable projects), i.e., the interaction term (Rep*AI) is expected to be positive.[19] Consistent with the previous argument, I find a positive and statistically significant coefficient under alternative definitions of investment (column (3)). Regarding the economic significance, this estimates implies that for a typical deviation of the asymmetric information variable, a one-standard-deviation increase in stock repurchases increases capital expenditures by 10.7% (relative to the mean) in the following year.

Consider next the case of a cash-rich firm that has enough money to finance the investment project. The good firm's manager could still benefit from bargain repurchases (with excess cash) without a corresponding change in investment. In other words, signaling is irrelevant from the cash-rich firm's perspective because investment can be financed in any case. These are the firms that are defined as No EFD, and the results for this subsample are presented in column (4). The interaction Rep*AI is statistically indistinguishable from zero, regardless of the proxy for investment considered. On the contrary, in the case of EFD firms, actual repurchases play a role, particularly when asymmetric information is high. The interaction term is positive and statistically significant at the 1% level. Moreover, the interactions in both subsamples are statistically different (the t-statistics of the differences are 2.9 for CAPEX and 3.5 for CAPEX+RD).

Baker et al. (2003) find that equity-dependent firms exhibit a more positive sensitivity of investment to prices (Tobin's Q) and cash flow than No EFD firms. Using the alternative definition of dependence on external financing explained above, I find that the coefficients for CF, Q and Return are statistically different in both subsamples and larger in the EFD group,[20] thereby providing support for the classification used to sort firms. Note that there is a negative relationship between asymmetric information and investment, consistent with Kim and Kung (2017). More important, this variable more severely affects firms that rely on external finance (the t-statistics of the differences are 3.0 and 2.3 for CAPEX and CAPEX+RD, respectively). The rest of the control variables have the expected signs: investment is negatively associated with firm size and leverage.

Managers could simultaneously profit from private information through insider

[19]The disclosure environment for publicly traded firms in the United States is relatively rich (Leuz and Verrecchia, 2000), and therefore, the effect is not expected to be found for the average firm that might already have other ways of conveying information to market participants.

[20]The t-statistics of the difference for CF are 3.6 and 4.5 for CAPEX and CAPEX+RD, respectively. The coefficients on Tobin's Q in Panel A are not statistically different from one another, but they are in Panel B (t-statistic=3.6). The difference is also significant for Return, with t-statistics of 3.4 and 3.2 in Panels A and B, respectively.

purchases and actual repurchases. The signaling power of insider purchases would arguably be stronger because, on the one hand, they are a relatively rare event (compared to stock repurchases). On the other hand, firm insiders are already highly exposed to firm risk, as they also have their personal capital invested in the firm. Moreover, insider trading disclosure is timelier than information about open market repurchases (Fried, 2014), therefore the market could learn the firm's type even before repurchase activity is disclosed, and there would be no place for stock repurchases as a signal. In Table 3, I check whether insider purchases are driving the result. In particular, I estimate the regressions when excluding firm-quarters with positive insider purchases. The coefficients are economically and statistically indistinguishable from the benchmark results (see Table 2). While a lower effect would be expected after excluding these firm-quarters, the results remain highly significant, suggesting that the findings are not driven by insiders signaling using their own wealth. Moreover, it seems that direct and indirect insider trading would be used differently (see Marín and Sureda-Gomila (2006) and Section 2.4.2 below), and that could partially explain why the coefficients do not vary substantially.

2.4.2 Instrumental variable approach

Instrumental variable methodology

Previous studies find that stock repurchases are negatively associated with investment. An omitted variable could be at least partly responsible for this negative relationship because as firms mature and lose profitable investment opportunities, they might choose to distribute cash to shareholders (Grullon and Michaely, 2004). In other words, endogeneity would induce a downward bias of the estimates. To address this concern, I use an instrumental variables approach. In particular, I instrument actual repurchases with exogenous price pressures in stock prices due to fire sales by distressed mutual funds. The first-stage estimation is the following:

$$Repurchases_{it} = \alpha_0 DPP_{it} + \beta_0 DPP_{it} * AI_{it} + \delta_0 AI_{it} + \gamma_0 X_{it-1} + \eta_i + \theta_t + u_{it}, \quad (2.2)$$

where $Repurchases_{it}$, AI_{it} and X_{it-1}, are defined as above, and the instrument, DPP_{it}, is the dummy variable for price pressure. Similar proxies for price pressures have been previously used in the literature (see, for instance, Coval and Stafford, 2007; Khan et al., 2012; Edmans et al., 2012). Building on these papers, I construct the variable as follows. I first estimate quarterly mutual fund flows based on total net assets and mutual fund returns[21] and define as "distressed" those mutual funds with flows in the top and bottom deciles of the distribution of flows. That

[21] In particular, the measure is as follows: $MFF_{j,t} = (TNA_{j,t} - TNA_{j,t-1}(1 + R_{j,t-1}))/TNA_{j,t-1}$, where TNA is total net assets, and R is fund j's return.

is, extreme inflows (outflows) are those in the top (bottom) decile. Then, for each stock, I sum all purchases by mutual funds with extreme inflows and subtract mutual funds sales with extreme outflows, both at the quarter level. Finally, the dummy variable DPP_{it} is equal to 1 if the difference between inflows and outflows (normalized by the trading volume) for a firm in a given quarter is smaller than -50% of the firm's trading volume (see Appendix C for further details). At this point, I differ from previous papers that regard as undervalued those stocks in the first decile of the distribution. The reason is that, by taking the lowest decile, I force 10% of the firms to be undervalued in each quarter, while that is not necessarily the case.[22]

The economic rationale for the instrument is the following: when investors that own shares in a mutual fund want to redeem their positions, fund managers will first attempt to use cash holdings to meet redemptions. When cash holdings are insufficient, they have to sell part of the portfolio of shares because regulations and self-imposed constraints prevent them from short-selling other assets to raise funds (Almazan, Brown, Carlson, and Chapman, 2004; Coval and Stafford, 2007). Distressed mutual funds (those with outflows exceeding their cash holdings) will create price pressure in the stocks that they are selling, and the effect is substantial when fire sales are concentrated in a limited number of securities (whenever there are no mutual funds with extreme inflows fire-purchasing those assets). These create temporary misvaluations, and trading against distressed mutual funds generates positive abnormal returns. In particular, fire sales create opportunities for firms to buy back cheap shares and will therefore increase the probability and amount of share repurchases.

Table 4 presents summary statistics of mutual funds' characteristics and trading behavior in response to investors' redemptions. Funds are sorted into deciles, based on quarterly flows, where the first (last) row shows funds with the largest outflows (inflows). Several interesting characteristics arise from the table. First, there is substantial variation in quarterly mutual fund flows (column (2)). Funds in the lowest decile lose on average 18% of their assets in a given quarter, while funds in the highest receive 35%. Funds in extreme deciles are significantly smaller in terms of total net assets (and, to some extent, the number of holdings) than mutual funds around the median flow deciles (columns (4) and (5)). Importantly, mutual funds with extreme inflows expand 57% of their positions (column (8)), while their counterparts with extreme outflows reduce 47% of positions (column (9)). Even when the former eliminate fewer positions than the latter (column (10)), the figures are not significantly different (nor do they show differences in

[22]The results are qualitatively similar using Coval and Stafford (2007) definition, but the first stage is weaker, particularly for the EFD subsample. The same holds when I consider alternative thresholds (different from the 50%) in the definition of DPP_{it}.

the fraction of new positions, column (6)). Their trading behavior seems consistent with mutual funds following an investment strategy and maintaining it even when they are distressed. These results provide support for the exclusion restriction, showing that, on average, mutual funds with extreme outflows (inflows), sell (buy) according to their specific investment strategy, without significantly changing their portfolios.[23] Moreover, Coval and Stafford (2007) show that funds experiencing extreme flows do not trade with any greater frequency in larger, more liquid, or better-performing holdings than funds with intermediate flows.

Stocks with downward price pressure, $DPP = 1$, experience negative abnormal returns around the quarter in which mutual funds are heavily selling. However, this effect reverses after some months, which is consistent with the argument that these fire sales are unrelated to firms' prospects. Figure 1, Panel A shows that firms with downward price pressure have negative abnormal returns in the months around the event, measured as stock return in excess of the Carhart four-factor model. The event quarter comprises months -2 to 0.[24] The mean abnormal returns are negative and statistically significant from -5 to -1, and they become positive after the event (but they are only statistically significant in some months). Panel B of Figure 1 presents the cumulative abnormal returns (CARs) for all firms suffering from price pressure. The pattern is similar to that presented in Coval and Stafford (2007) and Edmans et al. (2012). Note, however, that for the sample period considered in this paper, the duration of the mispricing is shorter, as is the negative abnormal return. This is consistent with investors learning and dissipating the mispricing following academic publications (McLean and Pontiff, 2016). Finally, Panel C shows the CARs for firms that repurchase shares in the event quarter (dashed line) and firms that do not (solid line). While repurchasing firms seem to revert their negative CAR faster, the differences in unconditional means are not statistically significant. Both panels show that misvaluations created by distressed mutual funds are temporary and that CARs become statistically indistinguishable from zero after some months.

To further support the exclusion restriction, Table 5 depicts the pre-existing differences in the investment variables between firms that suffer from exogenous price pressures and firms that do not. In particular, I regress the lagged levels of and changes in CAPEX and CAPEX + RD, to the proxy for price pressure, DPP, controlling for linear controls and time and firm fixed effects (Almeida et al., 2016). The pre-trend analysis suggests that there are no statistically or economically significant differences in the levels (column (1)) or trends (columns (2) to (5)) of the dependent variables between treated and non-treated firms. Warusaw-

[23]These results are consistent with Coval and Stafford (2007) (Table 2, pp.487) and Khan et al. (2012) (Table 1, pp.1376).

[24]Month 0 (the event month) is defined as the last month of the calendar quarter.

itharana and Whited (2016) estimate a structural dynamic model of investment and financial policies, and they find a "near-zero" response of investment to mispricing, particularly for large firms. In the case of small firms, they report that overvaluation increases equity issuance, and the proceeds are used to hoard cash and to fund real investment, mitigating the effects of the financial frictions. Similarly, in reduced-form estimations Hau and Lai (2013) and Campello and Graham (2013) analyze the effect of underpricing and overpricing, respectively, and they find that while the former reduces investment, the latter increases it, and the effect operates through financial constraints. In other words, the results from previous studies indicate that, if anything, the instrument would be biased against finding results, as downward price pressures would tighten financial constraints.

First-stage estimation

In addition to the exclusion restriction, a good instrument has to satisfy the relevance condition, i.e., the instrument and the endogenous variable have to be strongly correlated. The first-stage estimation provides a formal test for the relevance condition, and the results are presented in Table 6. In Panel A, I show the results of Equation 2.2, excluding the interaction term and the asymmetric information variable, for alternative definitions of repurchases (the full specification is presented in Panel B). In column (1), the dependent variable is a dummy equal to one if the firm repurchases shares in a given quarter, zero otherwise. The results show that firms that suffer from exogenous price pressures are 2.07% more likely to repurchase shares in a given quarter, or 6% more likely compared to the unconditional mean. The coefficient is economically and statistically significant after controlling for known determinants of stock repurchases: free cash flows, past return, firm size, growth opportunities, and leverage. In column (2), the dependent variable is the ratio of share repurchases normalized by total shares outstanding, the main measure of stock repurchases used in the paper. The results show that downward price pressure increases repurchases by 13.5% relative to total shares outstanding.[25] The F-statistic is above 20, suggesting that the instrument is strong. In columns (3) and (4), repurchases are normalized by total assets and cash at the beginning of the quarter, respectively. The economic significance is similar in all cases regardless of the variable used to normalize stock repurchases.

Next, I analyze whether managers identify and exploit price pressure to time stock purchases. Following Khan et al. (2012), I define Insider Purchases as the ratio of shares purchased to the sum of shares sold and purchased in a given quarter. This is a very strong test of undervaluation and market timing ability because, for instance, financial constraints might limit managers' capacity to purchase shares.

[25]The unconditional mean repurchase (normalized by shares outstanding) is 0.0037.

Alternatively, managers might be reluctant to purchase shares if they already have a significant stake in the firm and are not willing to increase their private wealth exposure to this specific stock.[26] Column (5) of Table 6 presents the results of the regression of Insider Purchases on the dummy for price pressure. The results show that managers increase purchases (or reducing sales) in the quarter of the exogenous shock, consistent with Ali et al. (2011). The effect is statistically significant at the 1% level after controlling for observable and unobservable firm characteristics. Regarding the economic magnitude, the coefficient represents a 5.6% increase relative to the unconditional mean.

Stock repurchases are positively related to firms' cash flows and size and negatively related to leverage. The direction of the relationship is the opposite for insider purchases, which would suggest that insiders purchase shares when firms' financial slack is tighter (higher leverage, lower cash flows or firm size).[27] Taken together, the results suggest that managers have market timing ability, i.e., they buy shares when the stock price declines, consistent with Ben-Rephael et al. (2014). Brav, Graham, Harvey, and Michaely (2005) survey financial executives on payout policies and find that they repurchase shares when the stock price is below the fundamental value.[28] Similarly, analyzing upward price pressure by mutual funds with high inflows, Khan et al. (2012) show that firms exploit the temporal misvaluation to issue equity through seasonal equity offerings to engage in stock-based acquisitions and insider sales.

Finally, Panel B shows the first-stage estimation when including the interaction with the market-based information asymmetry proxy for the full sample (columns (1) to (3)) and for the subsample of firms that are most reliant on external financing (columns (4) to (6)). Importantly, DPP is a good predictor of actual repurchases (t-statistics>3, both in the full and the subsample of EFD firms) and DPP*AI is positive and statistically significant for the regression on Rep*AI. In the last rows, I report the Sanderson and Windmeijer (2016) tests for underidentification and weak instruments, which suggest that the instruments are good.

[26]Moreover, trade-disclosure rules are more stringent when insiders engage in direct trading, relative to dealing via the corporation, favoring the latter over the former when trading on private information (Fried, 2014). However, because this shock is unrelated to firms prospects, it is unlikely to contain private information, and to be an illegal transaction.

[27]Marín and Sureda-Gomila (2006) suggest that firms and insiders might specialize in different types of mispricings. The evidence presented here likely indicates that insiders act as buyers of last resort when firms are constrained to do so. A further investigation of this issue is beyond the scope of this paper.

[28]This is the most popular response for all stock repurchase questions on the survey: 86.4% of all firms agree or strongly agree with this statement (Brav et al., 2005, pp. 514).

Second-stage estimation

The endogenous relationship between stock repurchases nd investment suggest that OLS results might be downward biased. In this section I address this concern. Columns (1) and (2) of Table 7 present the results of the causal effect of open market repurchases on investment, measured by CAPEX (Panel A), and CAPEX + RD (Panel B). The results show that stock repurchases motivated by exogenous downward price pressures neither increase nor decrease investment. This finding is not surprising. There are several reasons that firms repurchase shares (to change their capital structure, to affect market liquidity, or simply to distribute excess cash), and they do not always induce firms to cut investment. Contrary to Fried (2015), these findings suggest that on average firms do not reduce investment to repurchase bargain stock repurchases that favor long-term (non-selling) shareholders.

Although the results seem to contradict Almeida et al. (2016), this is not necessarily the case. Because of the nature of the empirical design, their study and this one might be treating different firms, providing different local average treatment effects, and ultimately leading to distinct conclusions (in Section 2.6.2 I further explore this issue). In untabulated results, I find that the firms treated by the instrument used in this study are similar in observable characteristics (such as cash flows, profitability, and investment opportunities) to the average repurchaser in the population. The most notable difference is that small firms are more likely to repurchase shares when facing exogenous price pressures (DPP=1).[29] This finding is consistent with Ben-Rephael et al. (2014) who document that small firms repurchase shares at a lower price compared to their large counterparts.

More important, columns (3) to (5) show that there is substantial variation in investment when asymmetric information varies. As explained above, actual repurchases should help firms that are severely affected by asymmetric information to increase investment through the former's signaling effect. To explore this effect, in column (3), I include the interaction term between stock repurchases and the proxy for market-based asymmetric information (instrumented). The results show that this interaction is positive and statistically significant for CAPEX + RD, while it has the expected sign for CAPEX but is not statistically significant at conventional levels. Notice that once stock repurchases are instrumented, the negative and statistically significant effect of stock repurchases on firms with low information asymmetry (AI=0), presented in Table 2, vanishes. In general, the coefficient on Repurchases is no longer significant.

[29]The mean market capitalization of firms that repurchase shares when DPP=1 (DPP=0) is 6 (10) billion dollars, suggesting that small firms benefit more from supporting the stock price.

In columns (4) and (5), I re-run the regressions for the subsamples of No EFD and EFD firms, respectively. Consistent with the OLS results presented in Table (2), the interaction term is positive for the subsample of firms that rely on external funds to finance investment projects, which benefit the most from signaling their type. The economic significance is large. Consider column (5) of Panel B: the 3.18 coefficient means that a 10% increase in stock repurchases (given a typical increase in AI) leads to a 7% increase in CAPEX+RD in the following year (relative to the unconditional mean). The interaction is negative and statistically indistinguishable from zero for cash-rich firms.[30] Moreover, the coefficient on AI shows that EFD firms are more severely affected by adverse selection when they do not repurchase shares. The lack of stock repurchases would signal that the firm is bad, and therefore, if the firm does not have excess cash, it does not increase investment in the following year. Finally, columns (6) of Panels A and B exclude firm-quarters with positive insider purchases. The coefficient on the interaction term is positive and statistically significant in Panel B, and are qualitatively the same as in the benchmark case (column (5)), which suggests that actual repurchases have a signaling effect that is distinct from direct insider trading.[31]

There are two potential concerns that might affect the results presented in Table 7 and could partially explain the relatively low t-statistics. On the one hand, the instrument for Repurchases might negatively affect investment in financially constrained firms (Warusawitharana and Whited, 2016; Hau and Lai, 2013), which would bias the analysis against finding results, as explained in Section 2.4.2.[32] On the other hand, note that, theoretically, DPP*AI is a valid instrument for Rep*AI if Repurchases is the only endogenous variable in the model. However, the market-based proxy for information asymmetry is probably also endogenous. In the next section, I employ an alternative and plausibly exogenous proxy for asymmetric information to address this concern.

2.4.3 Alternative proxy for asymmetric information

The instrumental variable approach used in the previous section is intended to address the endogeneity in stock repurchases. However, some concerns may remain regarding the endogeneity of asymmetric information at the firm level, based

[30]The instrument is weak for the No EFD subsample, so the results should be carefully interpreted.

[31]The tests for the weak instruments and underidentification suggest that the instrument is still robust for this subsample (untabulated).

[32]Unfortunately, this is a limitation of the instrument, which can increase standard errors and downward bias the coefficients.

on the bid-ask spread. Other firm-level variables used in previous papers, such as the number of analysts or R&D expenditures, might suffer from the same issues (Bharath, Pasquariello, and Wu, 2008). One possible way of addressing that concern is to include an instrument for that variable. Alternatively, a plausibly exogenous proxy for asymmetric information could be used. In this section, I will follow the second approach.

I construct a ranked variable based on the mean quarterly VIX index, calculated by the Chicago Board Options Exchange. Similar to the firm-level proxy for asymmetric information, the VIX variable varies from zero (low uncertainty, $VIX = 0$) to one (high uncertainty, $VIX = 1$). This variable is a measure of the implied volatility of S&P 500 index options, and it is plausibly exogenous to individual firms and, in particular, to the subsample of EFD firms that is composed of smaller companies (the mean size of firms in the (No EFD) EFD group is (6.3) 3 billion dollars). Kim and Kung (2017) argue that the VIX index captures the volatility of firms' market value, i.e., the higher the index, the harder it is for uninformed investors to distinguish between firm types. The disadvantage of using this measure is that the variation comes only at the time-series level, but it is constant for all firms in the same quarter.

The results for the EFD firms using the alternative proxy for asymmetric information are presented in Table 8.[33] In columns (1) and (5), I estimate the panel fixed-effects model (without year-quarter fixed effects) for CAPEX and CAPEX+RD, respectively. Consistent with the benchmark results (Table 2), there is high variation in the effect of actual repurchases on investment when asymmetric information varies. The interaction term is positive and statistically significant. Moreover, consistent with Kim and Kung (2017), I find a negative relationship between the VIX and investment. This negative effect of asymmetric information is stronger for the EFD group (the t-statistic on the difference between the coefficients is 2.1, untabulated). The coefficient on Repurchases is statistically equal to zero, suggesting that in settings with very low asymmetric information (VIX=0), stock repurchases do not have real effects. In columns (2) and (6), I include quarter-year fixed effects (the VIX is omitted in this case), and the results are qualitatively similar.

The rest of the table presents the estimates when actual repurchases and the interaction term are instrumented. The same conclusions stated above hold when endogeneity is addressed, which suggests that the effect is not likely to be driven by omitted variables. Moreover, the magnitude of the coefficients is larger, consistent with a downward biased in the fixed-effects estimation. In addition, the significance is generally stronger when using the VIX rather than the firm-level

[33]The results for the full sample and No EFD firms are available upon request.

proxy for information asymmetry. This positive coefficient in column (4) (column (8)) means that given a typical increase in the VIX, a 10% increase in stock repurchases leads to an 5.9% (2.8%) increase in CAPEX (CAPEX+RD) (relative to the unconditional mean) in the following year, similar to the effect documented using the alternative proxy for asymmetric information.[34]

Finally, in Panel B, I present tests for underidentification and weak identification in the subsample of EFD firms. In columns (1) to (3), I present the test when including the VIX variable, while in columns (4) to (6), I report the test results for the alternative specifications, including quarter-year fixed effects. In all cases, the null hypothesis of weak identification is rejected.

2.5 Mechanism

Stock repurchases increase investment because they allow firms to raise funds to finance profitable investment projects at a lower cost of capital. Previous papers provide preliminary support for that argument. For instance, Billett and Xue (2007) find that announcements of SEOs that were preceded by repurchase program announcements have better stock market reactions compared to those SEOs that were not preceded by repurchases. This result suggests that firms that signal their type can raise equity with a lower discount.[35] Moreover, the authors show that when the SEO and repurchase announcement are closer, and firms actually repurchase shares, the SEO announcement return is not statistically different from zero, while the returns when the announcements are distant or firms do not repurchase shares are between -2 and -3% in the [0,1] interval around the event (and statistically significant).

In this section I analyze whether firms that signaling through actual repurchases increase external financing afterwards, and whether they obtain funds at a lower cost. Some comments are in order. First, I have no prior regarding the sources of financing that firms might choose, and in principle it could be either

[34]The most recent financial crisis could be considered a quasi-experiment for the main prediction of the paper, as uncertainty over firm type increased dramatically during this period, and good firms might have experienced greater benefits from signaling. In untabulated results, I create a dummy for the crisis period and interact it with stock repurchases. I find that the interaction term is positive and highly significant for EFD firms. In particular, when CAPEX is the dependent variable, $\beta_1 = 1.3$ (t-statistic=2.5) in the instrumented regression.

[35]The authors use a relatively small sample of 116 repurchase program announcements between 1985 and 1996 that were followed by 132 SEO announcements in the following three years.

debt or equity.[36] Second, stock repurchases could reduce the cost of capital and increase external financing in all firms, not only in EFD firms. For instance, if a cash-rich firm wants to increase its leverage (because of tax benefits or other reasons), it might want to do so at the lowest possible cost, and it could use stock repurchases to signal that it is a good firm. In other words, the only distinct prediction between EFD and No EFD firms is related to future investment. Finally, it is important to note that the exclusion restriction is probably violated in this case, as downward price pressure will directly increase the cost of equity issuance. Then, in relative terms, debt will be cheaper than equity when stock prices are depressed.

2.5.1 Financing policies

Table 9 presents estimates for the financing variables. I present OLS results in the first three columns (full sample, No EFD, and EFD, respectively) and the instrumented regressions in columns (4) and (5) using alternative proxies for asymmetric information (AI and VIX, respectively). In Panel A, I show changes in net debt issuance following stock repurchases. The interaction coefficient is positive but statistically insignificant for the full sample, and the positive coefficient is driven by the firms that are EFD. The coefficient is positive and marginally significant for this group (column (3)), while it presents the opposite sign for their cash-rich counterparts (column (4)). Moreover, the results survive after instrumenting stock repurchases with exogenous price pressures created by distressed mutual funds (columns (4) and (5)). The magnitude of the coefficient is large: for a given standard deviation increase in AI (VIX), a 10% increase in stock repurchases raises debt issuance by 6.7% (7.1%).

The effect on cash holdings is analyzed in Panel B. There is a strong negative association between stock repurchases and changes in cash holdings when asymmetric information is low (AI=0), which is consistent with previous findings documenting that firms distribute excess cash to shareholders through stock repurchases. Interestingly, the effect is no longer significant once the endogenous variable is instrumented (regardless of the degree of and proxy for asymmetric information). The interaction coefficient is statistically indistinguishable from zero, and the sign is inconsistent for alternative asymmetric information proxies. This result suggests that the effect is not driven by cash-rich firms that use excess cash to finance both share repurchases and increased investment. Contrary to this

[36] In my sample, I find that large (small) firms are more likely to use debt issuance (SEOs). However, there are other potential determinants of capital structure that tilt firms towards certain sources of financing (Fama and French, 2005; Strebulaev and Yang, 2013).

finding, Almeida et al. (2016) show that EPS-motivated repurchases reduce cash holdings without increasing external sources of finance.

Finally, Panel C presents the results for changes in equity issuance. Net equity issuance is estimated following the market-measure proxy proposed by Fama and French (2005). The authors argue that net cash from the statement of cash flows understates the equity issued because issues that do not produce cash, such as outright grants of stock to employees or issues to finance mergers, are not reflected in that account. The OLS results in column (1) show that firms that repurchase shares issue more equity in the following four quarters, and the effect is positively related to asymmetric information, but statistically insignificant. The same result holds I sort firms according to their dependence on external financing (columns (2) and (3)) or when stock repurchases are instrumented (columns (4) and (5)).

Overall, and consistent with the mechanism proposed in Section 2.2, stock repurchases are followed by increases in debt issuance for EFD firms, with no changes in mean cash holdings. Although some firms might be issuing equity to finance investment projects, the instrument is biased against finding this result because investors' liquidity needs depress prices, thereby increasing the cost of this source of financing.

2.5.2 Cost of capital

If actual repurchases convey information, repurchasers should access capital markets on better terms, i.e., at a lower cost. In this section, I investigate whether the cost of debt (measured by the bond yield spread) and equity (proxied by the discount around the SEO announcement date) are lower for firms that repurchase shares and, in particular, for firms suffering the most from asymmetric information. Data on new bond issues and SEOs are collected from the SDC Platinum Database. To test that prediction, I will estimate Equation 2.1 with the at-issue bond yield spread and CAR as dependent variables. Repurchases are measured as of the previous quarter or the mean repurchase in the previous four quarters.[37] Unfortunately, the instrument is not valid for the subsamples of debt issues and SEOs; therefore, I will only present OLS estimation results, which should be interpreted as an association rather than a causal relationship.

[37]Recall that repurchase activity is only disclosed at the end of the fiscal quarter; therefore, repurchases conducted in the same quarter as the debt or equity issuance cannot be used to signal firm type.

Cost of debt

The proxy for the cost of debt is the at-issue bond spread (Spread). The final sample comprises 1,244 new issuances from 473 unique firms (after merging SDC data with the main panel used throughout the paper). Panel A of Table 10 provides summary statistics for the new issues and firm characteristics. The mean spread of the new issue is 2.8%, and the principal amount is 537 million dollars. The median firm issuance has a credit rating of BBB-.[38] Issuers, are larger on average (mean market capitalization is 23 billion dollars, while in the main sample, the average is 4.3 billion), more profitable, have lower investment opportunities, and are more levered than the mean firm in the full sample.

The results on the effect of stock repurchases on the cost of debt are presented in Panel B. Column (1) presents the results for the full sample when stock repurchases are measured in $t-1$. Consistent with the signaling story, I find that there is a negative association between stock repurchases and the cost of debt and that the relationship is stronger when asymmetric information increases. The main coefficient of interest, β_1, is negative and statistically significant (t-statistic=-3.2). Columns (2) and (3) present the results for No EFD and EFD firms, respectively,[39] and indicate no statistical differences between the two groups, which suggests that repurchases could help both types of firms to reduce their cost of debt. In the rest of the table, I repeat the analysis while measuring repurchases as the average of the previous four quarters. Similar to Billett and Xue (2007), the results are stronger when the repurchase and the issuance are closer from one another (see Section 2.5.2). Overall, the results are consistent with the idea that stock repurchases help firms facing high asymmetric information to signal their type and reduce their cost of capital. The coefficient on Rep*AI in column (3) is -1.02; therefore, given a typical increase in AI (0.22 in this subsample), a one-standard-deviation increase in stock repurchases leads to a 0.21% decrease in the at-issue bond spread (a 7.6% decrease relative to the unconditional mean). The positive coefficient on AI suggests that the cost of debt is higher for firms facing high asymmetric information when they do not repurchase shares, as expected.

Cost of equity

The negative market reaction to SEOs is well documented in the literature (Asquith and Mullins, 1986; Billett and Xue, 2007). Intuitively, in a setting with asymmetric information, only overvalued firms would issue equity because current shareholders

[38]The S&P ratings are converted into an ordinal scale ranging from 1=CCC- to 21=AAA+.

[39]External financial needs are measured at the time of the repurchase.

would be diluted otherwise. However, firms could use stock repurchases before the announcement to convey their type to the market, thereby reducing the discount at which they issue those shares. Billett and Xue (2007) find that when companies announce repurchase programs and then issue equity, the market reacts less negatively. In this section, I follow a similar approach to test whether the positive effect of actual repurchases is increasing in asymmetric information.

The main proxies for the cost of equity are the CAR calculated using the market model (CAR) and the four-factor model (CAR_4F). The final sample comprises 466 unique firms. Panel A of Table 11 provides summary statistics for the SEOs and firm characteristics. The mean CAR (CAR_4F) in the [0,1] window around the SEO announcement is -2.22% (-2.23%), and the principal amount is 130 million dollars. Firms raising funds through SEOs are smaller on average (mean market capitalization is 1.4 billion dollars, while in the main sample, the average is 4.3 billion), less profitable, have higher investment opportunities, and are more levered than the average firm in the full sample.

Panel B presents the regression results for the market reaction in the [0,1] event window around the announcement of an SEO. In column (1), I present estimates for the full sample. The positive coefficient β_1 is consistent with the idea that stock repurchases before the SEO help firms to reduce asymmetric information, thereby lowering the discount at which they issue shares (higher CAR at the announcement). The result is similar when using the Cahart four-factor model (column (4)). Repurchases are measured at $t-1$, and all regressions include industry controls.[40] Interestingly, the coefficient is only significant for the subsample of firms that are EFD. The coefficient on Rep*AI in the last column is 9.8; therefore, given a typical increase in AI (0.3 in this subsample), a one-standard-deviation increase in stock repurchases leads to a 2.8% increase in the CAR around the announcement. This is economically sizable, given that the mean CAR_4F is -2.06. Finally, the negative coefficient on AI suggests that the discount is larger when asymmetric information is higher, as expected.

Finally, in untabulated results I find that the effects are not statistically significant when I measure stock repurchases as the mean in the four quarters before the SEO announcement quarter. This result is consistent with Billett and Xue (2007), who document that the firms conducting actual repurchases close to the announcement of the SEO have more favorable market reaction than other issuers and, in particular, that the discount for them is statistically equal to zero, while firms that repurchase far from the announcement experience a significant discount.

[40]Firm fixed effects are not feasible because I have less than two SEOs per firm on average.

2.6 Additional Tests

2.6.1 Insider ownership

So far, I have assumed throughout the tests that all companies have a manager (or insiders) with a sufficiently large stake in the firm to induce him or her to repurchase shares only in case of undervaluation. This assumption is motivated by Holderness (2009) which shows that blockholders are present in 96% of American public firms. Recall that actual stock repurchases can signal firm undervaluation because insiders are diluted whenever the firm repurchase overvalued shares, because they transfer value to selling (short-term) shareholder in such a case. In line with this argument, Babenko (2009) finds that the market reaction to repurchase program announcements is positively related to the manager's stock holdings.

I will first explore the results when firm-quarters with negligible levels of managerial ownership (below 1% of shares outstanding) are excluded.[41] The effect should be stronger in this case, because the potential dilution costs are increasing in managerial ownership. In columns (1) and (4) of Table 12, I re-estimate the instrumented regressions for EFD firms for CAPEX and CAPEX+RD, respectively. The coefficients on the interaction terms are larger than in the benchmark case (see Table 7), and statistically significant under alternative definitions of investment. Unfortunately, when I impose higher thresholds for managerial ownership the instrument becomes weaker, but a 1% stake seems to be a substantial fraction of the firm for an individual investor.[42]

Finally, in the rest of the table I analyze the results in the presence of potential long-term (and informed) investors, which would probably prevent stock repurchases if the firm is overvalued. I follow Bushee (1998, 2001) to identify investors that are more likely to have private information about the firm type. In particular, Bushee classifies institutional investors according to their investment horizon and portfolio diversification in *quasi-indexers*, *dedicated* and *transient* investors. The latter are well-diversified investors with high portfolio turnover. Quasi-indexers and dedicated are investors with low portfolio turnover, but while the former have a well diversified portfolio, the latter hold a small number of shares. Therefore,

[41] I only have managerial ownership data for 57% of the observations, meaning that I am assuming that firms with missing data have managerial ownership above those thresholds. The mean market capitalization of firms with non-missing data is 7.3 billion dollars, while the capitalization of firms with missing data is 0.7 billion dollars. Because being EFD is statistically negatively correlated with market capitalization, if I drop firms with missing managerial ownership, I lose the observations that likely drive the result. Moreover, managers of small firms are more likely to have significant stakes in their companies.

[42] For instance, for a manager of a firm in the first quartile of the distribution of market capitalization, a 1% is almost two million dollars investment in a the firm stock.

dedicated investors are more likely to have private information about the firm type, and to benefit from bargain stock repurchases (or, conversely, to be harmed by expensive repurchases). In columns (2) and (5) I estimate the instrumented regressions for the subsample of firms that have a dedicated investor owning at least 2% of the outstanding shares. Similarly, in columns (3) and (6) I increase the threshold to 4%. The results are economically and statistically stronger compared to the benchmark findings, particularly for CAPEX (see Table 7 for a comparison).

To sum up, the results presented in Table 12 suggest that stock repurchases help firms increasing investment because they signal firm quality. The credibility of the signal is enhanced by the presence of managerial and insiders ownership because firms are less likely to repurchase overvalued shares if their stake would be diluted. It could be argued that stock repurchases increase managerial ownership if managers do not tender, inducing them to exert more effort and reducing agency costs. This alternative story seems unlikely to be driving the results because the average firm in the EFT subsample already has substantial managerial ownerhsip (at least 4% in the average firm). Moreover, if agency cost were driving the findings, the estimates should be stronger for firms in which managers hold a lower proportion of the firm, but the results from Tables 7 and 12 show that this is not the case.

2.6.2 The effect of EPS targets

Almeida et al. (2016) show that managers are willing to cut investment to finance stock repurchases to meet EPS targets, while the results presented so far, provide evidence of stock repurchases increasing investment. Clearly, the firms driving the results in both studies are different, and so their incentives. If the intersection between the treated firms in both studies is not null, firms focusing on EPS targets could be *contaminating* the results, reducing the power of the tests. In other words, the results should be stronger once firms with the wrong incentives are dropped out from the sample.

However, stock repurchases are not the only instrument firms can use to manipulate EPS ratios to meet analysts consensus. They can also use accruals or real earnings manipulation. For instance, Burnett, Cripe, Martin, and McAllister (2012) show that firms use stock repurchases when manipulating accruals is harder because of higher auditor quality, while Young and Yang (2011), using a sample of UK firms, document that firms with EPS targets are more likely to manipulate this ratio using repurchases rather than working capital accruals. Following Almeida et al. (2016), I will identify firms with *pervasive* incentives as those around a zero pre-repurchase EPS surprise (in the interval (-0.003,0.003)). Alternatively, I will

consider those in the negative pre-repurchase EPS surprise (-0.003,0).[43] Table 13 presents the instrumented regressions after excluding firms that are more likely to engage in myopic behavior to meet EPS targets. The results are both economically and statistically stronger in these subsamples, consistent with the idea that firms with incentives to engage in short-term targets might bias against finding a result.

2.6.3 Signaling through dividends

Stock repurchases are not the only signaling device that firms can use to convey their type to uninformed investors. Several papers in the asymmetric information literature suggest that dividends can also play this role (Bhattacharya, 1979; Ofer and Thakor, 1987). Moreover, it might be argued that, because managers are reluctant to cut dividends (Brav et al., 2005), the credibility of this signal should be stronger. In the mechanism proposed in this paper, dividends cannot be used as a signaling tool because they do not allow for separation between firm types (as there is no dilution costs for bad-firm managers when distributing dividends). In this section I will explore whether firms are simultaneously using dividends to convey information, driving the results presented in this paper.

Columns (1) and (4) of Table 13 replicate the empirical strategy used in the panel regression model (Equation 2.1) but replacing repurchases with dividends. The results show that there is no statistically significant association between dividends and changes in investment, regardless of the level of asymmetric information. For brevity, I only report the results for the subsample of EFD firms.[44] In columns (2) and (5), I include the repurchase variable and its interaction with asymmetric information. Notice first that the coefficients on Div and Div*AI are quantitatively very similar. Moreover, the interaction terms for stock repurchases and information asymmetry are virtually the same after the inclusion of these new variables (see Table 2). In columns (3) and (6), I present the instrumented regressions, and the the results show that the magnitude of the effect is quantitatively similar when including dividends.

Finally, in column (7), I analyze whether exogenous price pressures induce firms to increase dividends to signal undervaluation. The estimate is statistically equal to zero, suggesting that when undervaluation is relatively large, managers prefer to signal using repurchases instead of dividends, which is consistent with Ofer and

[43]The pre-repurchase EPS surprise is calculated as $(E + I)/(S + \Delta S')$, where E is reported earnings, I is the foregone interest rate due to stock repurchases, S is the number of shares outstanding, and $\Delta S'$ is the number of shares repurchased in the quarter (Hribar et al., 2006; Almeida et al., 2016).

[44]In untabulated results, I find that the coefficient is also insignificant for the No EFD group.

Thakor (1987).[45] Ofer and Takor provide a model with risk-averse managers in which both stock repurchases and dividends convey information to the market. They predict that the former are preferred when the perceived undervaluation is relatively high (it should be large enough to compensate for the cost of increasing managerial exposure to the firm's stock), while dividends would be used when the firm is relatively fairly priced. Ultimately, the results suggest that firms do not use dividends to signal their type, and this variable is not driving the results presented above.

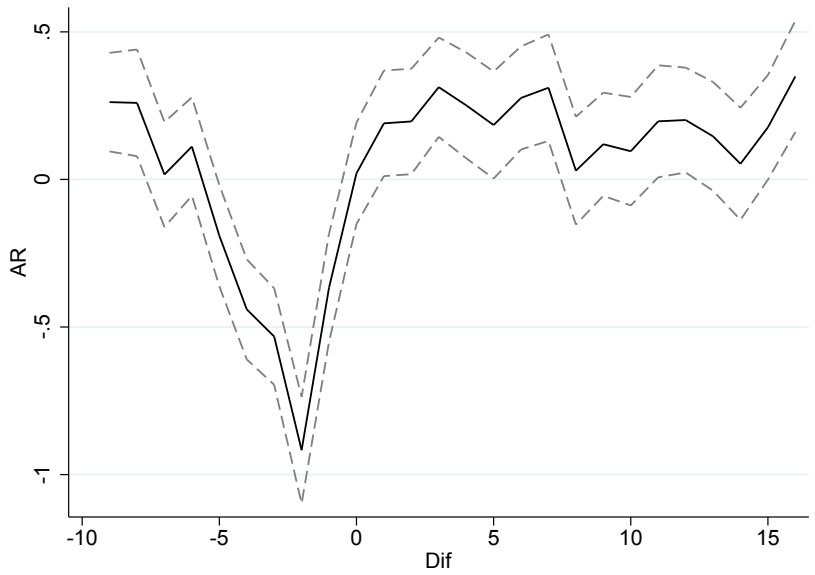
2.7 Conclusion

Many politicians and academics have recently spoken out against stock repurchases, arguing that firms are using profits to repurchase shares instead of investing in new projects to create jobs and sustainable economic growth. Despite these recent pronouncements, there is little empirical evidence on the effect of stock buybacks on real outcomes. While Almeida et al. (2016) find that managers trade off investments for share repurchases that allow them to meet or beat analysts' EPS forecasts, this paper shows that in the presence of severe asymmetric information, repurchases increase investment when firms have to access capital markets to finance their projects. In addition, actual repurchases increase price efficiency (Busch and Obernberger, 2017), and investors learn from the disclosure of this information (Ben-Rephael et al., 2014). These results suggest that repurchases might have beneficial effects for pricing and efficiency and that imposing restrictions on firms' ability to use them could be damaging. Moreover, it is not clear whether limiting stock repurchases is enough to prevent managers from manipulating the EPS figure to meet market expectations, as they could still engage in accruals or real earnings management to that end, which can also be costly for firms (Burnett et al., 2012; Young and Yang, 2011). In summary, it seems that a deeper understanding of the causes and consequences of stock repurchases is required to regulate them properly. If anything, a timelier disclosure of actual repurchases seems desirable to further increase the time informativeness of prices and reduce the transfer of value from selling to non-selling shareholders (Ben-Rephael et al., 2014; Fried, 2014).

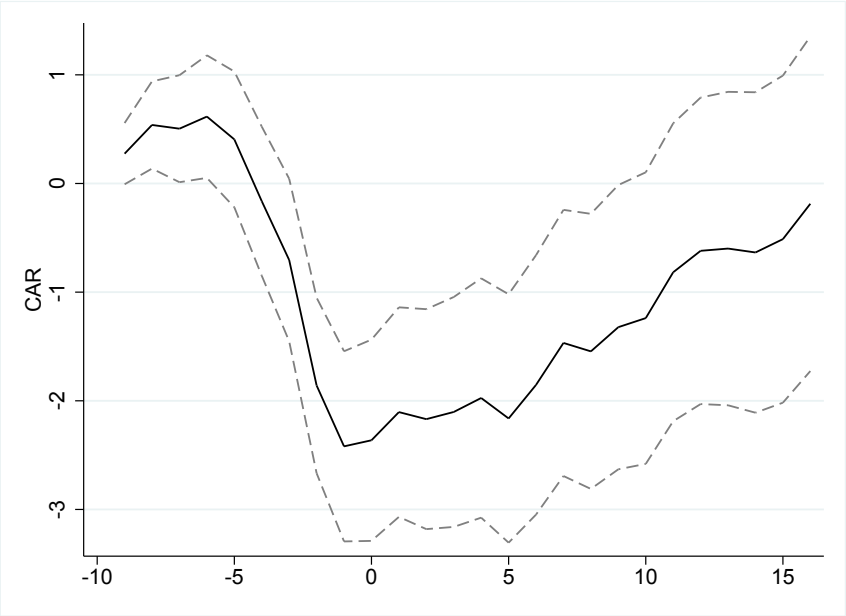
[45] The coefficient is zero in the full sample and in the No EFD sample.

Figure 1: Abnormal returns around mutual funds' trading pressure

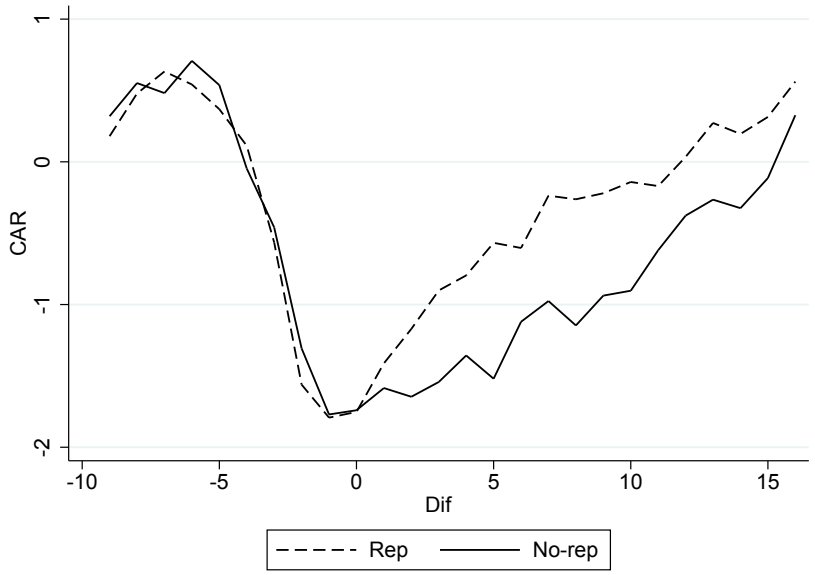
Panel A shows average monthly abnormal returns, measured as the returns in excess of the Carhart four-factor model, for firms experiencing exogenous price pressures. Dashed lines show 95% confidence intervals. Panel B presents monthly cumulative abnormal returns (solid line) and 95% confidence intervals (dashed lines) around mutual funds' trading pressure for all firms, while Panel C shows the cumulative abnormal returns for firms that repurchase shares in the event quarter (Rep, dashed line) and firms that do not repurchase (No-rep, solid line). The horizontal axes represent the number of months relative to the event. The event date, 0, is defined as the last month of the calendar quarter, and the event quarter is [-2,0].



Panel A: Average abnormal returns due to mutual funds' trading pressure.



Panel B: Cumulative abnormal returns around trading pressure.



Panel C: Cumulative abnormal returns for repurchasing and non-repurchasing firms.

Table 1: Firms' summary statistics

	Obs	Mean	S.D.	Q1	Median	Q3
Repurchases (indicator)	69816	0.344	0.48	0.00	0.00	1.00
If Rep>0:						
Repurchases (level)	24025	57.78	115.0	0.68	7.19	49.0
Repurchases (shares outstanding)	24025	0.011	0.01	0.00	0.01	0.02
Repurchases (total assets)	24025	0.016	0.02	0.00	0.01	0.02
Repurchases (cash)	23971	0.205	0.34	0.01	0.06	0.22
CAPEX	69816	0.013	0.02	0.00	0.01	0.02
RD	69816	0.015	0.03	0.00	0.00	0.02
CAPEX + RD	69816	0.027	0.03	0.01	0.02	0.03
Cash	69814	0.219	0.23	0.04	0.13	0.32
Debt	69816	0.012	0.04	0.00	0.00	0.00
Common Equity Issuance	69808	0.022	0.17	0.00	0.00	0.01
Institutional ownership	65029	0.616	0.26	0.42	0.68	0.83
Mutual fund ownership	69277	0.205	0.13	0.10	0.20	0.30
Market Capitalization (billions)	69816	4.258	19.02	0.19	0.61	2.07
Size	69816	6.311	1.78	5.03	6.23	7.50
Cash Flow	69816	0.017	0.05	0.00	0.02	0.04
ROA	69783	0.008	0.22	0.00	0.05	0.10
Tobin's Q	69816	2.148	1.55	1.23	1.65	2.46
MB	67574	3.441	4.11	1.46	2.29	3.76
Leverage	69816	0.190	0.20	0.00	0.14	0.30
Dividends	69813	0.003	0.01	0.00	0.00	0.00

This table presents summary statistics for the main variables used in this paper. The main databases are Compustat, CRSP, and Thomson Reuters. All the variables are defined in Appendix B.

Table 2: Panel regression results

Panel A: CAPEX					
	(1)	(2)	(3)	(4)	(5)
Repurchases	-0.0097	-0.0069	-0.0324	-0.0168	-0.0322
	(-1.5413)	(-1.0895)	(-3.7491)	(-2.2562)	(-1.9645)
Rep*AI			0.0741	0.0134	0.1304
			(4.0342)	(0.7077)	(3.6524)
AI			-0.0027	-0.0009	-0.0031
			(-6.0913)	(-1.8359)	(-5.5195)
CF	0.0109	0.0096	0.0094	0.0030	0.0119
	(7.5781)	(6.6322)	(6.5120)	(1.9205)	(6.2280)
Q	0.0017	0.0015	0.0013	0.0015	0.0012
	(12.2498)	(10.2685)	(9.3083)	(6.2672)	(7.0154)
Return		0.0042	0.0041	0.0028	0.0045
		(14.9594)	(14.6501)	(8.2652)	(12.1232)
Size		-0.0040	-0.0045	-0.0028	-0.0049
		(-10.1338)	(-10.8202)	(-5.7988)	(-9.3179)
Lev		-0.0080	-0.0075	-0.0044	-0.0083
		(-6.5959)	(-6.3383)	(-3.4249)	(-5.1248)
Sample	All	All	All	No EFD	EFD
Observations	69,816	69,816	69,816	28,432	41,141
Adj within R2	0.0177	0.0432	0.0446	0.0287	0.0449

The table presents the results of the panel fixed-effects estimation. The dependent variables are CAPEX (Panel A) and CAPEX+RD (Panel B). In column (1), I control for investment opportunities (Q) and cash flows (CF). In column (2), I include other known determinants of investment, firm size (Size), past return (Return) and leverage (Lev). In column (3), I include the interaction with the proxy for asymmetric information (AI). Columns (4) and (5) present the results for the subsamples of external finance independent (No EFD) and external finance dependent (EFD) firms, respectively. All regressions include quarter-year and firm fixed effects. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Panel B: CAPEX+RD					
	(1)	(2)	(3)	(4)	(5)
Repurchases	-0.0178	-0.0181	-0.0591	-0.0267	-0.0632
	(-2.2124)	(-2.1481)	(-5.3998)	(-3.1316)	(-3.1362)
Rep*AI			0.1209	0.0223	0.1945
			(4.8265)	(1.0263)	(4.3082)
AI			-0.0032	-0.0014	-0.0038
			(-5.1834)	(-2.4783)	(-4.5634)
CF	0.0312	0.0271	0.0269	0.0102	0.0362
	(7.9682)	(7.2246)	(7.1641)	(3.6004)	(7.1488)
Q	0.0039	0.0035	0.0034	0.0017	0.0036
	(12.8887)	(11.4438)	(10.8674)	(4.8380)	(9.0850)
Return		0.0071	0.0070	0.0032	0.0084
		(14.4036)	(14.2219)	(7.2408)	(11.8225)
Size		-0.0053	-0.0058	-0.0038	-0.0064
		(-7.6311)	(-8.1461)	(-5.2007)	(-6.5554)
Lev		-0.0176	-0.0170	-0.0080	-0.0206
		(-7.3632)	(-7.1680)	(-4.2950)	(-6.0201)
Sample	All	All	All	No EFD	EFD
Observations	69,816	69,816	69,816	28,432	41,141
Adj within R2	0.0381	0.0648	0.0656	0.0305	0.0695

Table 3: Insider trading

	CAPEX			CAPEX+RD		
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-0.0299	-0.0176	-0.0294	-0.0513	-0.0268	-0.0523
	(-3.3207)	(-2.3253)	(-1.6832)	(-4.5740)	(-3.0734)	(-2.4221)
Rep*AI	0.0640	0.0104	0.1131	0.0976	0.0200	0.1460
	(3.2001)	(0.5209)	(2.8902)	(3.7111)	(0.8866)	(2.9708)
AI	-0.0024	-0.0010	-0.0027	-0.0029	-0.0016	-0.0033
	(-5.3237)	(-2.1589)	(-4.6540)	(-4.6195)	(-2.7752)	(-3.9224)
Sample	All	No EFD	EFD	All	No EFD	EFD
Observations	60,475	24,546	35,642	60,475	24,546	35,642
Adj within R2	0.042	0.030	0.040	0.064	0.032	0.067

This table presents additional analyses to panel fixed-effects estimations, excluding firm-quarters with positive net insider purchases. In columns (1) to (3), the dependent variable is CAPEX, while in columns (4) to (6), it is CAPEX + RD. All regressions include quarter-year and firm fixed effects and controls for known determinants of investment, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 4: Mutual fund summary statistics

Decile	Flow	Return	Number Holdings	TNA	Fraction of positions: Initiated	Maintained	Expanded	Reduced	Eliminated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 (Outflow)	-0.178	0.011	154	531	0.14	0.12	0.12	0.47	0.14
2	-0.069	0.014	146	906	0.13	0.19	0.16	0.38	0.14
3	-0.045	0.016	152	1117	0.13	0.23	0.17	0.34	0.13
4	-0.030	0.018	161	1533	0.13	0.27	0.18	0.30	0.12
5	-0.017	0.019	177	2136	0.12	0.30	0.20	0.26	0.11
6	-0.004	0.020	205	2435	0.11	0.32	0.24	0.22	0.11
7	0.011	0.021	225	2742	0.11	0.29	0.30	0.19	0.11
8	0.036	0.022	233	2424	0.11	0.24	0.39	0.16	0.10
9	0.085	0.025	193	1446	0.12	0.17	0.47	0.13	0.11
10 (Inflow)	0.351	0.032	164	700	0.13	0.10	0.57	0.10	0.11

This table presents summary statistics for the mutual funds used to create the dummy for price pressures. Mutual funds' returns are obtained from CRSP and their holdings from Thomson Reuters.

Table 5: Pre-existing difference in investment policies

	Level (t-1) (1)	Change (t-2 to t-1) (2)	Change (t-3 to t-1) (3)	Change (t-4 to t-1) (4)	Change (t-5 to t-1) (5)
Dependent variable: CAPEX					
DPP	0.0000	0.0000	0.0003	-0.0001	0.0000
	(0.0941)	(0.0798)	(1.3207)	(-0.4660)	(0.1707)
Adj within R2	0.0059	0.0010	0.0021	0.0023	0.0020
Dependent variable: CAPEX + RD					
DPP	0.0000	0.0000	0.0005	0.0001	0.0003
	(0.1930)	(0.1714)	(1.3234)	(0.1690)	(0.5798)
Adj within R2	0.0162	0.0013	0.0038	0.0008	0.0009
Observations	69,816	69,816	69,816	69,660	68,808

The table presents the results for pre-existing difference in investment policy: capital expenditures (CAPEX) and the sum of capital expenditures and research and development expenditure (CAPEX + RD). The dependent variables are the levels of (column (1)) and changes in (columns (2) to (5)) the investment variables. All regressions include quarter-year and firm fixed effects as well as known determinants of investment, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 6: First-stage estimation

Panel A: Alternative stock repurchase definitions					
		Repurchases			Insider
	Indicator	Sh. Out.	Assets	Cash	Purchases
	(1)	(2)	(3)	(4)	(5)
DPP	0.0207	0.0005	0.0006	0.0088	0.0117
	(5.0484)	(5.2169)	(4.5831)	(3.7499)	(2.6773)
CF	0.0403	0.0010	0.0048	-0.0711	-0.3405
	(1.0706)	(1.2923)	(3.5917)	(-3.8663)	(-7.0070)
Q	-0.0052	-0.0003	0.0004	0.0028	-0.0477
	(-1.7780)	(-6.5170)	(3.5130)	(2.6236)	(-14.4715)
Return	-0.0271	-0.0011	-0.0009	-0.0126	-0.1928
	(-4.6175)	(-8.3728)	(-4.6809)	(-5.0375)	(-18.3577)
Size	0.0561	0.0007	0.0015	0.0138	-0.0809
	(5.8173)	(4.6927)	(6.0777)	(3.4770)	(-9.0038)
Lev	-0.2781	-0.0061	-0.0102	-0.1242	0.1390
	(-9.0439)	(-10.7629)	(-11.1763)	(-8.4175)	(5.0211)
Observations	69,816	69,816	69,816	69,564	45,554
F-test	25.49	27.22	21.00	13.41	14.06

Panel B: Interactions						
	Repurchases	Repurchases	Rep*AI	Repurchases	Repurchases	Rep*AI
	(1)	(2)	(3)	(4)	(5)	(6)
DPP	0.0005	0.0007	0.0001	0.0005	0.0007	0.0001
	(5.2169)	(4.0939)	(1.5477)	(4.4737)	(3.4796)	(1.1705)
DPP*AI		-0.0004	0.0005		-0.0005	0.0004
		(-1.3713)	(2.8809)		(-1.2751)	(2.1463)
AI		-0.0009	0.0031		-0.0009	0.0019
		(-3.8342)	(20.4256)		(-3.8643)	(13.7116)
CF	0.0010	0.0010	0.0004	-0.0006	-0.0007	-0.0001
	(1.2923)	(1.2062)	(0.8909)	(-0.7734)	(-0.8459)	(-0.3152)
Q	-0.0003	-0.0003	-0.0000	-0.0002	-0.0003	-0.0000
	(-6.5170)	(-7.4090)	(-2.1567)	(-5.7634)	(-6.8067)	(-2.3813)
Return	-0.0011	-0.0011	-0.0003	-0.0010	-0.0010	-0.0003
	(-8.3728)	(-8.6954)	(-3.9241)	(-6.6066)	(-6.8926)	(-3.4241)
Size	0.0007	0.0006	0.0006	0.0005	0.0003	0.0004
	(4.6927)	(3.6710)	(7.5660)	(3.6589)	(2.4135)	(5.5180)
Lev	-0.0061	-0.0060	-0.0026	-0.0037	-0.0036	-0.0014
	(-10.7629)	(-10.5201)	(-10.4923)	(-7.2270)	(-6.9900)	(-6.7959)
Sample	All	All	All	EFD	EFD	EFD
Observations	69,816	69,816	69,816	41,141	41,141	41,141
SW Chi-sq test	27.22	19.83	29.09	20.01	14.91	14.88
P-value	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
SW F(1,3040)	27.24	19.81	29.06			
SW F(1,2791)				20.04	14.88	16.80

Table 6 presents the first-stage estimation results. Panel A shows the first stage under alternative definitions of stock repurchases: an indicator variable that is equal to one if the firm repurchases shares in the quarter, repurchases normalized by shares outstanding, assets or cash (columns (1), (2), (3) and (4), respectively) and insider trading (column (5)) defined as the ratio of insider purchases normalized by the sum of insider sales and purchases. Panel B presents the first-stage estimation for the interaction in the full sample (columns (1) to (3)) and the subsample of EFD firms (columns (4) to (6)). All regressions include quarter-year and firm fixed effects. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 7: Second-stage estimation

	Panel A: CAPEX					
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-0.2354	0.0921	-0.1905	0.8580	-0.6529	-0.4295
	(-1.0817)	(0.3793)	(-0.5885)	(1.2109)	(-1.3207)	(-0.9100)
Rep*AI			0.5031	-1.9192	1.6663	1.4445
			(0.7402)	(-1.6148)	(1.4965)	(1.2795)
AI			-0.0041	0.0097	-0.0067	-0.0057
			(-1.6965)	(1.4787)	(-2.5169)	(-2.1173)
Sample	All	All	All	No EFD	EFD	EFD
Insider Purchases	All	All	All	All	All	≤ 0
Controls	CF,Q	All	All	All	All	All
Observations	69,816	69,816	69,816	28,432	41,141	35,642
	Panel B: CAPEX+RD					
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-0.3558	0.1235	-0.7646	0.1897	-1.3764	-1.2610
	(-1.0893)	(0.3413)	(-1.6112)	(0.3167)	(-1.8024)	(-1.7300)
Rep*AI			1.6864	-0.4237	3.1832	3.2861
			(1.6850)	(-0.3571)	(1.7910)	(1.8249)
AI			-0.0088	0.0010	-0.0110	-0.0107
			(-2.4559)	(0.1543)	(-2.6008)	(-2.5144)
Sample	All	All	All	No EFD	EFD	EFD
Insider Purchases	All	All	All	All	All	≤ 0
Controls	CF,Q	All	All	All	All	All
Observations	69,816	69,816	69,816	28,432	41,141	35,642

Table 7 presents the second-stage estimation for the investment variables: CAPEX (Panel A) and CAPEX + RD (Panel B). All regressions include year and firm fixed effects. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 8: Alternative proxy for asymmetric information

Panel A								
	CAPEX				CAPEX+INV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Repurchases	-0.009	-0.008	-1.684	-1.253	-0.036	-0.036	-2.102	-1.272
	(-0.478)	(-0.436)	(-1.924)	(-1.513)	(-1.376)	(-1.368)	(-1.620)	(-1.034)
Rep*VIX	0.049	0.042	2.700	2.465	0.094	0.077	3.232	2.461
	(1.858)	(1.563)	(2.660)	(2.479)	(2.567)	(2.042)	(2.178)	(1.717)
VIX	-0.003		-0.009		-0.004		-0.012	
	(-6.326)		(-3.649)		(-6.082)		(-3.222)	
Estimation	OLS	OLS	IV	IV	OLS	OLS	IV	IV
Observations	41,141	41,141	41,141	41,141	41,141	41,141	41,141	41,141
Quarter-year FE	NO	YES	NO	YES	NO	YES	NO	YES

Panel B						
Specification:	Columns (3) and (7)			Columns (4) and (8)		
	SW Chi-sq(1)	P-val	SW F(1,2874)	SW Chi-sq(1)	P-val	SW F(1,2874)
Repurchases	11.11	0.0009	11.10	10.76	0.0010	10.75
Rep*VIX	11.30	0.0008	11.29	11.12	0.0009	11.10

Panel A of Table 8 presents the second-stage estimation for the investment variables: CAPEX (columns (1) to (4)) and CAPEX + RD (columns (5) and (8)) for the subsample of EFD firms. Columns (1)-(2) and (5)-(6) present the OLS results, and Columns (3)-(4) and (7)-(8) show the instrumented regressions. All regressions include firm fixed effects and firm controls, X. Panel B reports the results of underidentification and weak identification tests for the instrumental variable estimations. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 9: Financing policies

Panel A: DEBT					
	(1)	(2)	(3)	(4)	(5)
Repurchases	-0.0350	0.0551	-0.0654	-2.2686	-2.8910
	(-1.3026)	(1.9402)	(-1.3884)	(-1.3149)	(-1.0937)
Rep*AI	0.0526	-0.1143	0.1574	6.3648	
	(0.9498)	(-1.8305)	(1.7325)	(1.9104)	
Rep*VIX					6.3569
					(2.0321)
Panel B: CASH					
	(1)	(2)	(3)	(4)	(5)
Repurchases	-1.2138	-0.9198	-1.0781	-10.2861	1.3655
	(-9.9499)	(-9.7924)	(-5.6359)	(-1.6181)	(0.1400)
Rep*AI	0.4150	-0.0115	0.0825	21.0822	
	(1.6429)	(-0.0462)	(0.2164)	(1.4661)	
Rep*VIX					-3.4238
					(-0.3106)
Panel C: EQUITY					
	(1)	(2)	(3)	(4)	(5)
Repurchases	0.1342	0.1209	0.2610	1.5588	0.2969
	(2.8498)	(2.1245)	(3.8247)	(0.5819)	(0.0633)
Rep*AI	0.1311	0.0982	-0.1108	1.9147	
	(1.3755)	(0.9435)	(-0.7322)	(0.2683)	
Rep*VIX					3.9256
					(0.6942)
Estimation	OLS	OLS	OLS	IV	IV
Sample	All	No EFD	EFD	EFD	EFD
Observations	69,806	28,424	41,139	41,139	41,139

Table 9 presents the results for the financing variables: net debt issuance (DEBT, Panel A), cash holdings (CASH, Panel B), and net equity issuance (EQUITY, Panel C). In columns (1) to (4), the proxy for asymmetric information is AI, while in columns (5), it is the VIX. The first three columns present OLS regressions for the full sample, No EFD firms and EFD firms, respectively, and the last two columns show the instrumented coefficients. All regressions include firm and time fixed effects and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 10: Cost of debt

Panel A: Summary statistics						
	Obs	Mean	S.D.	Q1	Median	Q3
Bond variables						
Principal (millions)	1244	537	418	300	450	600
Spread	1244	0.028	0.02	0.01	0.02	0.04
Rating	1227	10.422	3.52	8.00	11.00	13.00
Maturity (years)	1244	10.298	6.89	7.00	10.00	10.00
Public	1244	0.998	0.04	1.00	1.00	1.00
Callable	1244	0.084	0.28	0.00	0.00	0.00
Firm variables						
MktCap	1244	23.07	44.16	2.70	7.59	21.74
Size	1244	8.940	1.21	8.07	8.94	9.97
CF	1244	0.028	0.03	0.01	0.03	0.04
ROA	1244	0.061	0.09	0.03	0.06	0.10
Q	1244	1.787	0.73	1.28	1.61	2.14
Lev	1244	0.311	0.17	0.19	0.29	0.40

Panel B: Spread						
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-0.0387	-0.0086	0.0052	-0.0696	-0.0315	-0.0693
	(-1.5141)	(-0.1626)	(0.1153)	(-1.6260)	(-0.3353)	(-1.2328)
Rep*AI	-0.6377	-1.0032	-1.0216	-0.5669	-0.7330	-0.5924
	(-3.2295)	(-2.6463)	(-2.4054)	(-2.0419)	(-2.1130)	(-1.4819)
AI	0.0143	0.0245	0.0117	0.0140	0.0178	0.0114
	(3.4006)	(2.8583)	(2.2987)	(2.7131)	(2.4012)	(2.4981)
Time to maturity	0.0000	0.0001	0.0000	0.0000	0.0002	0.0001
	(0.9492)	(2.4093)	(0.0211)	(0.8771)	(2.2326)	(1.2009)
Sample	All	No EFD	EFD	All	No EFD	EFD
Repurchases	t-1	t-1	t-1	(t-1,t-4)	(t-1,t-4)	(t-1,t-4)
Observations	1,044	337	549	1,044	179	755
Adj within R2	0.108	0.203	0.0603	0.0998	0.215	0.106

Panel A of Table 10 presents summary statistics for new debt issuance. Panel B shows the results of estimating Equation 2.1. The dependent variable is the debt spread at the time of the bond issue. In columns (1) to (3), the explanatory variable is stock repurchases in the previous quarter, while in columns (4) to (6), it is the average repurchase in the previous 4 quarters. All regressions include firm and time fixed effects and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 11: Cost of equity

Panel A: Summary statistics						
	Obs	Mean	S.D.	Q1	Median	Q3
SEO variables						
Principal (millions)	569	130	231	28.13	67.50	140
CAR	574	-0.022	0.10	-0.07	-0.02	0.03
Firm variables						
MktCap	574	1.37	3.89	0.15	0.38	0.97
Size	574	5.683	1.76	4.38	5.60	6.82
CF	574	-0.006	0.08	-0.03	0.01	0.04
ROA	574	-0.094	0.35	-0.13	0.02	0.07
Q	574	2.773	2.34	1.34	1.92	3.16
Lev	574	0.260	0.23	0.05	0.24	0.39

Panel B: Cumulative abnormal return						
		CAR			CAR_4F	
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-3.8651	-13.3765	-3.8156	-3.9396	-11.7888	-3.9299
	(-3.6774)	(-1.3958)	(-3.7735)	(-3.4560)	(-1.2827)	(-3.6094)
Rep*AI	4.9086	25.5016	7.4777	6.1978	23.3369	9.8364
	(2.1237)	(1.3522)	(3.9793)	(2.1579)	(1.3088)	(4.6933)
AI	-0.0405	-0.0248	-0.0478	-0.0431	-0.0234	-0.0515
	(-1.7214)	(-0.3488)	(-1.6412)	(-1.7486)	(-0.3514)	(-1.7453)
Sample	All	No EFD	EFD	All	No EFD	EFD
Repurchases	t-1	t-1	t-1	t-1	t-1	t-1
Observations	567	105	426	567	105	426
Adj within R2	0.055	0.081	0.053	0.059	0.059	0.062

Table 11 presents the cross-sectional estimation for the cost of equity, measured by the cumulative abnormal return in the [0,1] window around the SEO announcement. All regressions include time and industry fixed effects (2-digit SIC code) and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the quarter-year level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 12: Insider ownership

	CAPEX			INV		
	(1)	(2)	(3)	(4)	(5)	(6)
Repurchases	-1.4432	-1.1331	-1.4252	-2.2575	-1.7971	-1.7219
	(-1.4504)	(-1.7932)	(-2.0479)	(-1.4434)	(-1.7998)	(-1.6859)
Rep*AI	3.1420	3.3521	3.6948	5.0048	4.7797	4.8756
	(1.8480)	(1.6909)	(2.0961)	(1.8696)	(1.5839)	(1.8125)
AI	-0.0096	-0.0099	-0.0119	-0.0134	-0.0151	-0.0173
	(-2.7114)	(-2.2227)	(-2.7249)	(-2.4079)	(-2.2362)	(-2.6040)
Sample	EFD	EFD	EFD	EFD	EFD	EFD
Insider ownership	MO>1%	DED>2%	DED>4%	MO>1%	DED>2%	DED>4%
Observations	31,406	12,080	8,773	31,406	12,080	8,773
P-value (Rep)	0.0192	0.0004	0.0043	0.0192	0.0004	0.0043
P-value (Rep*AI)	0.0006	0.0023	0.0022	0.0006	0.0023	0.0022

Table 12 presents the second-stage estimation for the investment variables: CAPEX (columns (1) and (3)) and CAPEX + RD (columns (4) and (6)) for the subsample of EFD firms. Columns (1) and (3) present the results when firms with negligible managerial ownership are excluded. Columns (2) and (5) show the estimations when firms have at least one dedicated investor (Bushee, 1998, 2001) with 2% ownership, while in columns (3) and (6), there is at least one dedicated investor owning 4% of the shares outstanding. All regressions include year and firm fixed effects and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 13: The effect of EPS targets

	CAPEX		INV	
	(1)	(2)	(3)	(4)
Repurchases	-1.6295	-0.8595	-2.9357	-1.5693
	(-1.2225)	(-1.5795)	(-1.3517)	(-1.8552)
Rep*AI	3.6757	2.1150	6.5587	3.5880
	(1.6677)	(1.8545)	(1.7899)	(1.9786)
AI	-0.0095	-0.0076	-0.0139	-0.0118
	(-2.6974)	(-3.0067)	(-2.3690)	(-2.9734)
Sample	EFD	EFD	EFD	EFD
Sue_adj excluded	(-0.003,0.003)	(-0.003,0)	(-0.003,0.003)	(-0.003,0)
Observations	19,044	33,250	19,044	33,250
P-value (Rep)	0.0349	0.0002	0.0349	0.0002
P-value (Rep*AI)	0.0055	0.0000	0.0055	0.0000

This table presents the instrumented regressions after excluding firm-quarters with pre-repurchase EPS surprise (Sue_adj) in the interval (-0.003,0.003) (columns (1) and (3)), and (-0.003,0) (columns (2) and (4)). All regressions include firm and time fixed effects and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Table 14: Signaling through dividends

	CAPEX			CAPEX+RD			Div
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Div	0.025	0.028	0.053	-0.008	-0.005	0.043	
	(0.541)	(0.594)	(1.065)	(-0.136)	(-0.078)	(0.649)	
Div*AI	0.036	0.033	0.004	0.067	0.063	0.009	
	(0.530)	(0.487)	(0.051)	(0.735)	(0.693)	(0.082)	
Repurchases		-0.032	-0.660		-0.063	-1.383	
		(-1.972)	(-1.335)		(-3.138)	(-1.810)	
Rep*AI		0.131	1.677		0.194	3.191	
		(3.657)	(1.509)		(4.307)	(1.798)	
AI	-0.003	-0.003	-0.007	-0.004	-0.004	-0.011	
	(-4.978)	(-5.354)	(-2.578)	(-4.083)	(-4.479)	(-2.658)	
DPP							0.000
							(0.426)
Estimation	OLS	OLS	IV	OLS	OLS	IV	OLS
Sample	EFD	EFD	EFD	EFD	EFD	EFD	EFD
Observations	41,140	41,140	41,140	41,140	41,140	41,140	41,140

In this table, I analyze whether dividends are driving the results in the EFD sample. In columns (1) to (3), I analyze the association between dividends and CAPEX, while in columns (4) to (6), the dependent variable is CAPEX+RD. The last columns analyze whether exogenous price pressures increase dividends. All regressions include firm and time fixed effects and firm controls, X. Standard errors are robust to heteroskedasticity and clustered at the firm level. All variables are defined in Appendix B. t-statistics are reported below the coefficient estimates.

Chapter 3

The role of accounting quality during mutual fund fire sales

3.1 Introduction

In this paper we explore the role of financial reporting quality on mitigating the underpricing resulting from investors liquidity needs, i.e., unrelated to firm fundamentals. Lee and So (2015) argue that "Market prices are buffeted by a continuous flow of information, or rumours and innuendos disguised as information" (pp. 64). The process of incorporating relevant information into prices by market participants takes time and effort, and as a consequence firm stock prices might suffer deviations from the fundamental value. In particular, undervaluation is problematic for firms that need to raise funds externally, as they are likely to issue debt or equity at a discount, which has real effects (e.g. Baker et al., 2003; Edmans et al., 2012; Hau and Lai, 2013).

The objective of financial reporting is to provide information about the firm that is useful for current and potential investors decision-making. Higher financial reporting quality should mitigate information asymmetries, providing a better estimation of firms' fundamental, reducing adverse selection in the trading of securities, and promoting the efficient allocation of capital. This could be achieved, for example, if financial reporting facilitates the writing of better contracts that prevents the misuse of firm's resources, monitor managerial decisions, and earnings figures that provide more information about the firm's performance (e.g. Biddle, Hilary, and Verdi, 2009; Dechow, Ge, and Schrand, 2010).

Previous studies show that reporting quality matters in broad samples and over long periods (Francis, LaFond, Olsson, and Schipper, 2005; Jin and Myers, 2006; Biddle et al., 2009). However, some scholars cast doubts on the usefulness of ac-

counting information due to the use of noisy estimates and judgment calls, the lack of comparability of financial statements, and managerial incentives to misreport (Sherman and Young, 2016). If that were the case, investors might decide to rely on alternative (arguably, more timely and reliable) sources of information, such as analysts recommendations (Sulaeman and Wei, 2018) or management earning forecasts (Kadach, 2017), to assess the value of a firm. That is, whether accounting quality matters, particularly during periods of severe underpricing, is ultimately an empirical question.

While previous studies have mainly analyzed the role of accounting quality in incorporating fundamental information into stock prices, its role during the arrival of non-fundamental information has been generally left unaddressed. Recent studies documented that correlated mutual funds liquidity needs are an important source of price pressure for the stocks that these mutual funds hold in their portfolios, causing temporary mispricing in these securities (e.g. Coval and Stafford, 2007; Ali et al., 2011; Khan et al., 2012; Sulaeman and Wei, 2018).

Analyzing the role of accounting quality in this setting is motivated by several reasons. On the one hand, this shock is arguably exogenous to firms fundamentals. Previous papers documented price reversals following mutual fund fire sales, consistent with the temporary mispricing. We also document this finding for our sample period (see Figure 1).[1] On the other hand, the price impact of mutual funds fire sales are significant and long-lasting. The cumulative abnormal return might drop up to -14% and it can take more than one year to return to fundamental value (Coval and Stafford, 2007; Sulaeman and Wei, 2018), which can distort real activities (Edmans et al., 2012; Khan et al., 2012; Hau and Lai, 2013). To sum up, the exogeneity of the shock, and the strong impact on prices (and the associated real effects it might have) make it an ideal setting to analyze the role of accounting quality.

We build on Coval and Stafford (2007) to create our proxy for exogenous price pressure. The authors show that when mutual funds (which own a significant fraction of American publicly traded firms) face strong liquidity needs because of investors redemptions, they might be forced to fire sale part of the assets they hold in their portfolios, generating temporary misvaluations in the stocks that they sell. Fire sales due to mutual funds liquidity needs increase uncertainty regarding the value of firms suffering price pressures, and therefore, increases the need for reliable information to accurately price stocks. Lee and So (2015) argue

[1]Also consistent with this arguments, Ali et al. (2011) show that forced sales and purchases do not predict changes in future performance. On the other hand, we find that distressed mutual funds reduce or eliminate 62% of their positions (untabulated), which makes it unlikely that they cherry pick the stock they sell based on expected future prospects. Kadach (2017) finds similar figures (see Table 2, p.41).

that the extent to which prices may differ from fundamentals are driven by the cost that informed arbitrageurs face when they are pricing securities. If financial reports fulfill their role of reducing information asymmetries between the firm and market participants, firms with better accounting quality should experience less severe mispricings. Therefore, we predict that firms with better accounting quality will have a lower negative price impact when mutual funds fire sale their portfolio holdings, because high-quality accruals help investors pricing firms more accurately through a reduction in the uncertainty regarding firm value.

We construct our main proxy for accounting quality based on the aforementioned argument that financial reporting should provide information about the firm's operations, especially its cash flows. In particular, the accruals component of earnings are valuable if they can be linked to cash flows and provide valuable information to estimate the firm's stock price. Namely, the higher the link between accruals and cash flows, the more valuable accruals are to investors, as they smooth out transitory fluctuations in cash flows. Building on this idea, Dechow and Dichev (2002) derive a measure of accrual quality as the residuals from the regression of changes in working capital on past, present, and future operating cash flows. We use the augmented version suggested by McNichols (2002) (which also considers changes in revenue and property plant and equipment as explanatory variables) as our main proxy for accounting quality.

Consistent with our prediction, we find evidence that firms with higher financial reporting quality have lower deviations from fundamental value compared to their lower quality counterparts. In particular, we find that firms in the top quintiles of accounting quality experience an abnormal return (using the 4-factor model as a benchmark) of -0.96%, while those in the bottom quintiles have an abnormal return more than 4 times larger (-4.2%) in the quarter in which mutual fund experience liquidity needs. In terms of economic significance, an increase of one decile of accounting quality increases the abnormal return by 0.255% in the quarter of the shock, 0.603% when including the previous quarter, and 0.708% when considering also the following quarter. These figures imply a 17% to 20% reduction in the mispricing during those event windows. These results hold after controlling for firm and stock characteristics previously considered in the literature (e.g., institutional ownership, market capitalization, analysts coverage), and are robust to a wide set of additional tests, such as alternative benchmarks to estimate abnormal returns, the inclusion of additional controls, the use of median regression that is less sensitive to the effect of outliers, or the exclusion of financial and regulated firms and alternative earnings quality measures [2]. These findings are consistent the value relevance of accounting information (Francis et al., 2005), and

[2]We also consider the unadjusted Dechow and Dichev (2002) proxy and results remain qualitatively similar.

suggests that having better accounting quality help investors disentangling noise from fundamental information in equity prices, and causing smaller deviations from fundamental value.

Some alternative explanations for our results would be either that the measures for accounting quality are capturing the effect of governance, or that they proxy for firms complexity. Regarding the former, the inclusion of controls for institutional ownership and analysts coverage, two widely used proxies for governance, help us to reduce this concerns. Regarding the latter, prior research shows that firm complexity makes it harder for market participant to understand and incorporate firm specific information into prices (Cohen and Lou, 2012; Barinov, Park, and Yildizhan, 2016). We want to rule out the possibility that our proxy for accruals quality might be capturing firm complexity, rather than the extent to which accruals map into cash-flows, we include additional controls for firm economic fundamentals (the length of the operating cycle, the volatility of sales and cash flows and the incidence of losses over the last 10 years) that previous studies find to affect accruals quality (Francis et al., 2005). We find that firm complexity is not driving the results, and that the economic magnitude remains fairly stable after including these additional variables.

Moreover, our result are robust to alternative definitions of accounting quality. Previous literature suggests that conditional conservatism is a desirable property of financial reporting (Khan and Watts, 2009), as it provides a hard benchmark to evaluate firm performance (e.g., LaFond and Watts, 2008; García-Lara, García-Osma, and Penalva, 2016). In additional tests we find that more conservative firms return to fundamental value faster, but we do not find consistent evidence of conservatism reducing the mispricing during or before the event quarter. Finally, we exclude multiple shocks to a firm in the same year to rule out the possibility of the results being driven by firms suffering continuous shocks. All the aforementioned conclusions remain unchanged in this reduced sample.

We contribute to the literature in several ways. First, this paper contributes to the literature exploring how internal and external stakeholders actions can mitigate misvaluations driven by mutual fund liquidity needs. Previous studies look at insider trading and option grants (Ali et al., 2011), management earnings forecasts (Kadach, 2017) or analysts recommendations (Sulaeman and Wei, 2018). To the best of our knowledge our paper is the first to look at the effect of financial reporting quality in mitigating mispricing due to mutual funds fire sales. Understanding how insiders and outsiders actions may attenuate mispricing is particularly important, as several papers document that fire sales and purchases have real effects (Coval and Stafford, 2007; Edmans et al., 2012; Khan et al., 2012; Hau and Lai, 2013).

Second, we contribute to the literature on the usefulness of high quality finan-

cial reporting reducing information asymmetries when the firm faces exogenous market shocks. In this sense, our paper relates to Hilary (2008) who finds that firms with better accounting quality experience a lower mispricing during catastrophic market events compared to firms with low accounting quality. Hilary (2008) explores firms mispricing in the 10 lowest return days between 1981 and 2006. Our setting allow us to provide a better identification of the relationship between specific firm mispricing and reporting quality and a clearer interpretation of the results, as our findings are not likely to be confounded by other factors such as changes in risk aversion, which are likely to occur during catastrophic market events.

Finally, our paper is also related to the extensive body of research that shows that stock prices under-react to earnings announcements (e.g., Ball and Brown, 1968), changes in analysts recommendations (e.g., Womack, 1996), or other major corporate events. Some explanations for the price drifts include methodological issues (Fama, 1998), behavioral explanations (disposition effect) (Frazzini, 2006), the lack of institutional investors attention to these news (Ben-Rephael, Da, and Israelsen, 2017b), or firm complexity (Cohen and Lou, 2012; Barinov et al., 2016). In this paper, we contribute to this debate proposing that the quality of the accounting information might partly explain the slow incorporation of news to prices. We depart from previous papers by exploiting an exogenous mispricing event, that is unrelated to firms fundamentals, to test our main predictions that firms with higher accounting quality have lower mispricings.

3.2 Data and Research Design

3.2.1 Sample

The sample period spans from 2004 until 2016.[3] We use several databases. Financial information is gathered from Compustat. We collect data on stock prices from CRSP and keep all ordinary shares (share codes 10 and 11) traded on the NYSE, AMEX, and NASDAQ (exchange codes 1, 2, and 3). To identify firm-quarters with exogenous price pressures we gather data on mutual funs' holdings, returns and total net assets from Thomson Reuters and CRSP Mutual Fund database. Finally, the risk-free rate and factors data used to estimate abnormal returns is collected from the Kenneth R. French Data Library.

[3]We start in 2004 because since that year, mutual funds have to disclose their portfolio holdings on a quarterly basis, reducing measurement error in our proxy for price pressure. The last year is 2016 because we need data on future cash flows to estimate the proxies of accounting quality.

3.2.2 Variable definition

Mispricing

Open-end mutual funds are important market players in American stock markets. From time to time they face liquidity needs because investors redemptions might exceed cash available. When that happens, mutual funds might be forced to fire sale part of the assets they hold in their portfolios. Similarly, funds might receive large inflows in a given period, forcing managers to quickly buy stocks, to avoid accumulating cash above the optimal level. Coval and Stafford (2007) show that forced sales (purchases) can be particularly costly when there is overlap of securities among distressed mutual funds, because prices deviate from fundamental value, causing temporary misvaluations of the assets that are being sold. Several previous papers have exploit this shock, relying on some variation of their proxy to identify stock mispricing (Ali et al., 2011; Edmans et al., 2012; Khan et al., 2012).

Building on that idea, we mainly follow Coval and Stafford (2007) to create our proxy for exogenous price pressures. First of all, we identify distressed mutual funds, as those having extreme flows in a given quarter. Mutual fund flow are obtained as follows:[4]

$$MFF_{jt} = \frac{TNA_{j,t} - TNA_{j,t-1}(1 + R_{j,t})}{TNA_{j,t-1}}, \tag{3.1}$$

where $TNA_{j,t}$ are fund's j total net assets of the quarter t, and $R_{j,t}$ is the fund's j return in t.[5] We drop highly concentrated funds (less than 10 holdings), and those with extreme changes in TNA.[6] Then, distressed mutual fund are those in the top and lowest deciles of the distribution of flows in a given quarter.

Secondly, for each stock, we obtain a proxy for price pressure, $Pressure_{it}$, as the difference between outflow-induced sales and inflow-induced purchases, and we normalize it by the average trading volume:

$$Pressure_{i,t} = \frac{\Sigma_j(max(0, - \triangle H)|MFF_{j,t} < P(10th)) - \Sigma_j(max(0, \triangle H)|MFF_{j,t} > P(90th))}{Vol_{i,t-1}}, \tag{3.2}$$

[4] In line with previous papers, we drop balanced, bond, money market, and international mutual funds, as well as those that do not primarily invest in US common equity.

[5] CRSP Mutual Fund database provides monthly data for returns and total net assets, but stock holdings are only available on a quarterly basis. Therefore, in order to merge both databases we convert all the variables to quarterly frequency.

[6] Following Coval and Stafford (2007) we keep those $-50\% < \triangle TNA < 200\%$.

where $\triangle H$ is the change in holding from quarter $t-1$ to quarter t, and $Vol_{i,t-1}$ is the trading volume in the previous quarter. Finally, following previous studies, we define a firm to be suffering fire sales if it is in the top decile of the distribution of $Pressure$. We require firms to be owned at least by five mutual funds to calculate this variable (Coval and Stafford, 2007; Ali et al., 2011; Sulaeman and Wei, 2018).

Abnormal returns

We use the four-factor model (Carhart, 1997) as our main benchmarks to estimate abnormal returns. For each firm i and month t we estimate the abnormal return from regressing each month excess return on the monthly market (Rm-Rf), the size (SMB), book-to-market (HML), and momentun (WML) factors using the 60 previous months of data:

$$R_{i,t}-r_f = \alpha_{i,t}+\beta_{MKT}(R_{M,t}-r_f)+\beta_{SMB}SMB_t+\beta_{HML}HML_t+\beta_{WML}WML_t+\epsilon_{i,t} \tag{3.3}$$

and calculate the abnormal returns, AR^{4f}, as the difference between the actual return and the return predicted by the model. We then aggregate the returns quarterly to get the cumulative return around the quarter of the shock CAR_q^{4f}, where $q = 0, (-1, 0), (-1, 1)$, where q are quarters relative to the event quarter. We use consider the market model as an alternative benchmark to check the robustness of the results, and estimate the monthly abnormal returns, AR^{mm}, and the cumulative abnormal returns, CAR_q^{mm}, where $q = 0, (-1, 0), (-1, 1)$.

Accounting quality

Our benchmark proxy for earnings quality is based on Dechow and Dichev (2002) model, which captures the extent to which working capital accruals map into cash-flows from operations. We follow McNichols (2002) to augment their model to include the change in revenue and property, plant and equipment. This proxy has been widely used in the literature (Francis et al., 2005; Biddle et al., 2009), which increases comparability with prior studies. It basically captures uncertainty in accruals quality (Francis et al., 2005; Hilary, 2008), and we believe it best capture the uncertainty perceived by investors when using accounting information to asses the value of a firm.

Dechow and Dichev (2002) estimate their model regressing total accruals (earnings before extraordinary items and discontinued operations (Compustat, ibc) minus the operating cash flows (Compustat, oancf) in year t), on cash from operating activities (Compustat, oancf) relative to total assets (Compustat, at) in years t, $t+1$ and $t-1$. Following McNichols (2002) we include the change in revenues

(Compustat, revt) and property, plant and equipment (Compustat, ppegt) as additional explanatory variables in the Dechow and Dichev (2002) model. The model is estimated for each year-industry (defined by the Fama and French 48 industry groups) with at least 20 observations, to obtain a firm- and year-specific estimation of the residuals. The accruals quality proxy, AQ_DD_MN, is the standard deviation of the residuals from the previous regressions over the past 5 years, multiplied by minus one, so that the higher AQ_DD_MN, the higher the accounting quality. For robustness, we also consider the unadjusted Dechow and Dichev (2002) proxy, AQ_DD.

In additional tests we use conditional conservatism as an alternative proxy for accounting quality. We follow Khan and Watts (2009) in the construction of the variable. This measure is based on Basu (1997) but it overcomes some of its limitations by taking into account how firm specific characteristics affect conditional conservatism over time. We consider two alternative proxies: the C-Score, C_Score, and the total score, $Total\_Score$, that is the sum of the C-Score and the G-Score.[7] Conservatism is increasing in both variables.

Finally, to control for outliers and non-linearities and facilitate the economic interpretation of the results we use deciles of the proxies of earnings quality and accounting conservatism (see for instance Francis et al., 2005).

Control variables

We create our plausible exogenous proxy for price pressure based on trading by distressed mutual funds. However, conditional on suffering the exogenous shock, the higher the fraction of *distressed trades*, the higher the expected mispricing. We therefore control for $Pressure$ in all our regressions, constructed following Equation 3.2.

We also include a set of control variables that might affect stock returns, following Ben-Rephael et al. (2017b). We control for firm size measured as the natural logarithm of stock market capitalization, $MktCap$ (Compustat, csho*prcc_f), growth opportunities calculated as the natural logarithm of the book-to-market ratio and Mkt_to_Book (Compustat, (at+(csho*prcc_f)-ceq-txdb)/at). Financial variables are calculated at the end of the previous fiscal year. We also control for institutional ownership measured as the fraction of shares outstanding owned by institutional investors at the beginning of the quarter of the shock, $InstHold$ (Thomson Reuters, instown_perc), and analysts coverage measured by the natural logarithm of one plus the number of analysts issuing EPS forecasts for the most recent fiscal year, $LnNumEst$ (IBES, numest).

[7] Following previous literature, we consider the three-year average of these variables (García-Lara et al., 2016).

In robustness tests we also consider a set of market-based variables calculated from monthly data and aggregated at the quarter level. We measure these variables with two lags to avoid the *bad controls* problem (Angrist and Pischke, 2008). In particular, the drop in the stock price might start before the event quarter, as suggested by Coval and Stafford (2007) and shown in Figure 1, and therefore using only one lag might be problematic. We follow Ben-Rephael et al. (2017b) in the selection and construction of these variables. We include the abnormal trading volume calculated as the stock trading volume divided by the average trading volume of the previous year, $AVol$ (CRSP, vol), the ratio of the stock high and low price difference and the high price, $HLtoH$ (CRSP, (askhi-bidlo)/askhi), the average raw return, Ret (CRSP, retx), stock liquidity measured as the monthly stock turnover, $Turnover$ (CRSP, vol/shrout), the stock spread, $Spread$ (CRSP, (ask-bid)/((ask+bid)/2)), and the standard deviation of stock returns, $SDRet$ (CRSP, retx).

Finally, more complex firms might have worse accruals quality simply because the accounting process cannot accurately capture firms fundamentals, which ultimately, might affect investors ability to price firms (Barinov et al., 2016). Building on Dechow and Dichev (2002), we control for cash flow volatility, S_CFO (Compustat, oancf), sales volatility, S_Sales (Compustat, sale),[8] firm operating cycle, $OperCycle$ (Compustat, (rect/sale)+(invt/cogs)), and the incidence of negative earnings over the past 10 years, $NegEarn$ (Compustat, ib).[9]

3.2.3 Empirical Framework

We use an event study methodology to examine whether accounting quality affects underpricing. Specifically, we run the following cross-sectional pooled regression:

$$CAR_i = \beta AQ_i + \gamma Controls_i + \epsilon_i \tag{3.4}$$

where CAR_i is the abnormal return of firm i around the quarter of the shock. AQ denotes the accounting quality of firm i in the previous fiscal year. Following Ben-Rephael et al. (2017b) and Hilary (2008), we include a set of control variables, $Controls$, that might affect returns: firm size, book-to-market ratio, institutional ownership, and analysts coverage (see Section 3.2.2). All continuous variables

[8]Cash flow and sales volatility are normalized by total assets, and estimated over a window of 10 years, with at least 5 observations per firm.

[9]Dechow and Dichev (2002) also control for firm size using the natural logarithm of total assets. We do not include this control because we re already controlling for market capitalization in all the regressions, and these variables are highly correlated. In untabulated tests we find that the result do not vary when we use total assets instead of market capitalization.

are winsorized to avoid the influence of outliers. We also include quarter-year and industry (defined by the Fama and French 48 industry groups) fixed-effects. The coefficient of interest is β and captures whether accounting quality impacts stock returns around exogenous price pressures, and we expect it to be negative. Standard errors are clustered at the firm level.

Figure 1 presents the monthly abnormal returns (top) and the cumulative returns (bottom) around the event quarter. Firms are grouped into those with high (continuous line, High AQ) and low (dashed line, Low AQ) accounting quality, according to the augmented McNichols (2002) model. The figure at the bottom shows that the mispricing is only temporarily, and that eventually all firms return to their fundamental value (zero cumulative abnormal return). This is an important preliminary result because we argue that the mispricing around mutual fund fire sales is unrelated to firms prospects. If they were due to fundamental, we should not observe a reversion of abnormal returns and our analysis could be more likely to suffer from endogeneity concerns. Figure 1 provides a clear overview of the main result of the paper: firms with better accounting quality have lower deviation from fundamental value, on average. The underpricing is deeper for firms with lower reporting quality, and it also last longer.[10] The CAR in the quarter of the shock (shaded area) between high and low accounting quality firms are statistically different, and lower for the latter.

3.3 Results

3.3.1 Summary statistics

Table 1 presents summary statistics of the full sample (Columns (1) to (6)) and the subsamples of high and low accounting quality (Columns (7)-(8) and (9)-(10), respectively). Data requirements to calculate the proxies for accounting quality and the abnormal returns bias our sample towards firms that are larger and more successful compared to the average firm in Compustat, a limitation that has been already pointed out in previous studies (e.g., Francis et al., 2005). The mean firm in our sample has a size, measure by the natural logarithm of total assets (market capitalization), of 6.6 (6.8), while the mean firm in Compustat has a size of 5.5 (5.2).[11] Regarding the market-to-book ratio, firms in our sample have a lower

[10] We do not exploit variations in the duration of the mispricing in this paper because it is difficult to define a starting date for the mispricing, as previous papers document that it can start well before the quarter of the shock if mutual funds anticipate outflows, and start selling in advance (Coval and Stafford, 2007).

[11] Summary statistics for the Compustat sample are untabulated, but they are available upon request.

mean but a higher median compared to Compustat firms.

Our sample includes firms with better accounting quality compared to the full Compustat sample for which we can compute these proxies. It could be that mutual funds, realizing that selling *hard-to-price* stocks will have a higher impact on price, might decide to sell *easy-to-price* stocks first.[12] Columns (7) and (9) also support this argument: while 4,083 firms are classified as High AQ, only 1,770 firms belong to the Low AQ group. The mean values of the C_Score and $Total\_Score$ are similar to those in the full Compustat sample.

Regarding the abnormal returns around mutual fund fire sales, we find that in the event quarter high (low) accounting quality firms suffer four factor (market) abnormal return of 0.96% (-4.2%), or -1.59% (-7.37%) during the event quarter and the previous one. Given our focus on recent years, it is not surprising that the abnormal returns presented in Table 1 are significantly lower than those documented in previous papers (e.g., Coval and Stafford, 2007; Sulaeman and Wei, 2018), as academic research tends to destroy stock return predictability (McLean and Pontiff, 2016). All in all, these statistics are consistent with the preliminary conclusions drawn from Figure 1 and point to the positive effect of accounting quality on stock returns when firms suffer from exogenous shocks to the stock price. Investors might take longer to disentangle the temporary mispricing from fundamental information in low accounting quality firms, further depressing stock prices (even though firms eventually return to fundamental value). In the rest of the paper we provide formal tests to further support our findings.

The rest of the summary statistics presented in Table 1 are consistent with recent studies exploiting this kind of mispricing (e.g., Kadach, 2017; Sulaeman and Wei, 2018).

3.3.2 Main results

Table 2 presents the main results of the paper. In columns (1) to (3) accounting quality is measured using the augmented McNichols (2002) model, while in Columns (4) to (6) we use the unadjusted Dechow and Dichev (2002) proxy. The table confirms the findings presented in Figure 1: firms with better accounting quality have higher cumulative abnormal returns when they suffer exogenous price pressures. In other words, accounting quality attenuates the (exogenous) mispricing. The result is robust to alternative definitions of accounting quality, different

[12]This result contradicts Coval and Stafford (2007) which finds that mutual fund do not mitigate the costs of their fire trades by selling larger, more liquid or better performing assets first. This conflicting result might be explained by the particularities of our sample size mentioned above, or by mutual funds learning through academic research (McLean and Pontiff, 2016).

event windows (0, (-1,0) and (-1,1)), alternative models to estimate abnormal returns (see Panel B), firm-level controls, industry and time fixed effects.

Regarding the economic magnitude of the effect, an increase of one decile in our main proxy for of accounting quality, $Decile\_DD\_MN$, increases the CAR by 0.255% in the quarter of the shock, 0.603% when including the previous quarter, and 0.708% in the broader even window, (-1,1). Compared to the unconditional mean, these results are substantial, representing a 17% to 20% reduction in the mispricing during those event windows. The effect is somehow smaller when accounting quality is measured using $Decile\_DD$ but remains significant after including a wide set of control variables. The results are qualitatively similar (and statistically stronger) when we use the market model to estimate abnormal returns (Panel B).

We find that the significance of the control variables is, in general, weaker than that for accounting quality, consistent with Hilary (2008). In particular, $Pressure$, the fraction of the average trading volume that is fire sold in the quarter of the shock, is negative (as expected), but it is not significant in all the specifications. Moreover, we control for institutional ownership, $InstHold$, and analysts coverage, $LnNumEst$, that previous papers consider as alternative corporate governance mechanisms (Biddle et al., 2009; García-Lara et al., 2016). Including this variables reduces concerns that the proxies for accounting quality might indeed be capturing the effect of governance mechanisms that are, in general, associated with reporting quality.

Interestingly, the coefficient on the fraction of institutional investors ownership is negative, and is the only variable that remains statistically significant in (almost) all regressions, and has the highest economic magnitude among the control variables. This result might seem surprising, because institutional investors are considered sophisticated shareholders, and therefore, they are expected to mitigate the effect of the exogenous mispricing. To the contrary, the negative coefficients suggest that they exacerbate the effect. Dennis and Strickland (2002) find that institutional investors herd together and trade with the momentum, contributing to market volatility, which is consistent with our finding.

Analysts are also considered informed stakeholders, and a higher number of analysts following the firm would be expected to reduce the mispricing through the fastest incorporation of news into prices. However, we find that the coefficient on $LnNumEst$, is negative, and in general, it is statistically insignificant. Sulaeman and Wei (2018) document that only 11 to 13% of analysts can identify mispricings caused by mutual fund liquidity needs. In other words, not all analysts are skilled, and therefore, increasing the number of analysts following the firm does not guarantee a reduction in asymmetric information, at least when firms experience shocks that are unrelated to fundamentals.

In Panels A, B and C of Table 3 we next check whether our results are robust to the inclusion of additional controls (Ben-Rephael et al., 2017b), to non-parametric estimation (Hilary, 2008), and to the exclusion of financial (SIC 6), regulated (SIC 49) and quasi-governamental (SIC 9) firms (Hilary, 2008), respectively. For the sake of brevity we only report results when the dependent variable is the abnormal return measured using the four factor model. However, the results are qualitatively the same (and statistically stronger) when using the market model (available upon request). In Panel A we include a set of additional controls that might be correlated with the dependent variable. We follow Ben-Rephael et al. (2017b) in the election for these additional market-level controls, $AVol$, $HLtoH$, Ret, $Turnover$, $Spread$, and $SDRet$. Overall the results indicate that the inclusion of these variables reduces the significance of the coefficients but they do not significantly affect the economic magnitude. However, one comment is in order. We show in Figure 1 that the drop in the stock price starts well before the event quarter, consistent with Coval and Stafford (2007). To mitigate the *bad-controls* problem (Angrist and Pischke, 2008), we estimate these variables with two lags. Still some concerns might remain that these explanatory variables are, indeed affected by the shock, and therefore we do not include them in our main specifications.

In Panel B, we present the results when using median regression. This specification has some advantages over OLS, such as being more robust to outliers, and avoiding assumptions about the distribution of the errors. The results presented in Panel B show that both the economic and the statistical significance are larger when we regress in the median rather than the mean, consistent with Hilary (2008). Finally, in Panel C we show that the results are qualitatively similar when we exclude financial, regulated and quasi-governmental firms, and the economic magnitude remains fairly stable across the different specifications. Overall we can conclude that the higher the mapping of accruals to cash flows, the lower the mispricing when mutual funds are fire selling the stock due to liquidity needs, consistent with financial reports being more useful to investors to price firms.

In untabulated results we also find that the coefficients remain significant after controlling for industry x quarter fixed effects, which suggests that within the same industry, and the same quarter, firms with higher accounting quality have lower deviations from fundamental value. In other words, these additional tests allow us to exclude the possibility that other confounding factors that do not vary within industry-quarter are driving the results.

3.3.3 Firm complexity

Prior research shows that firm complexity makes it more difficult for market participant to understand and incorporate firm specific information into prices. For

instance, Barinov et al. (2016) find that conglomerates have a larger post earnings announcement drift compared to single-segment firms. Cohen and Lou (2012) document that when there is an information event that affects an entire industry, firms that operate solely in that industry incorporate news into prices faster compared to a firm operating in multiple industries.

We want to rule out the possibility that our proxy for accruals quality might be capturing firm complexity, rather than the extent to which accruals map into cash-flows, and therefore to firm price. We follow Francis et al. (2005) and control for the innate components of accruals, i.e., firm economic fundamentals: the length of the operating cycle, the volatility of sales and cash flows and the incidence of losses over the last 10 years. In addition, we control for firm size in all our regressions. All these factors are expected to hinder accruals ability to capture economic fundamentals, leading to a reduction in accounting quality that is unrelated to managerial decisions.

The results are presented in Table 4 and show that the effect of accounting quality on stock mispricing remain economic and statistically significant after controlling for several determinants of firm complexity.[13] The inclusion of these additional controls mainly attenuate the impact of accounting quality in the quarter of the shock when we measure cumulative abnormal returns using the four-factor model, but not so in the broader event windows. However, non of these controls have a larger and consistent explanatory power, compared to accounting quality. In general the estimates are negative (as expected) but statistically insignificant.

In untabulated results we find that estimates are economically and statistically stronger when we estimate the above specifications using median regression. Moreover, the coefficient on $NegEarn$ is larger and statistically significant at the 1% level in all six specifications. The results on the remaining control variables are qualitatively the same. Finally, when we exclude financial, regulated and quasi-governamental firms the estimates remain fairly stable, and the all the results discussed above hold (untabulated).

Overall, we conclude that, while firm complexity might affect market participants ability to price securities, in the presence of exogenous price pressures caused by mutual fund liquidity needs, accounting quality plays an important and distinct role in enhancing market efficiency. Our results seem not to be driven by innate factors that might hinder financial reports ability to convey information about firm fundamentals.

[13] All the regressions include the controls included in the benchmark specification (pressure, institutional ownership, analysts coverage, market-to-book ratio) but we do not present them in the table to save space.

3.4 Additional tests

3.4.1 Alternative proxies for accounting quality

In this section we explore whether our findings hold when using alternative proxies for accounting quality. Previous literature suggests that accounting conservatism is a desirable property of financial reporting as it provides a hard benchmark to evaluate firm performance, imposing more severe verifiability requirements for the recognition of gains compared to losses (Basu, 1997; LaFond and Watts, 2008). The empirical evidence shows that conservatism enhances investment efficiency, reducing underinvestment (García-Lara et al., 2016) but also overinvestment (Francis and Martin, 2010). Building on this literature, we expect to find that firms that are more conservative would have lower deviations from fundamental value when an exogenous shock temporarily depresses stock prices.

The proxy for conditional conservatism is constructed following Khan and Watts (2009), and it is explained in Section 3.2.2. The results are presented in Table 5. In Panel A we present the results for the benchmark model, and show that conditional conservatism reduces stock mispricing during mutual fund fire sales, but the coefficients are only statistically significant for the broader event window (see Table 2 for comparison). The estimated coefficients are statistically (and in general, economically) stronger when we use median estimation instead of OLS regressions. These results are presented in Panel B and suggests that the presence of outliers might be biasing against finding a result in Panel A. Even though the economic significance is smaller when we proxy for accounting quality using conditional conservatism compared to accruals quality, the overall effect is still sizable: moving from one decile to the following one increases CAR by 18% compared to the unconditional mean.

To sum up, we conclude that having more conservative financial reporting also alleviate the mispricing caused by mutual fund fire sales, at least in the broader event window. While we cannot confidently conclude that it significantly reduces the deviation before and during the shock, we can conclude that accounting conservatism helps firm returning to fundamental value faster in the aftermath of the shock.

3.4.2 Multiple shocks

One potential concern regarding the empirical strategy followed along the paper is that the results might be driven by firms suffering multiple continuous shocks. To address this issue, for each firm with more than one shock in the same year we keep only the first observation, and drop the remaining ones. The results using

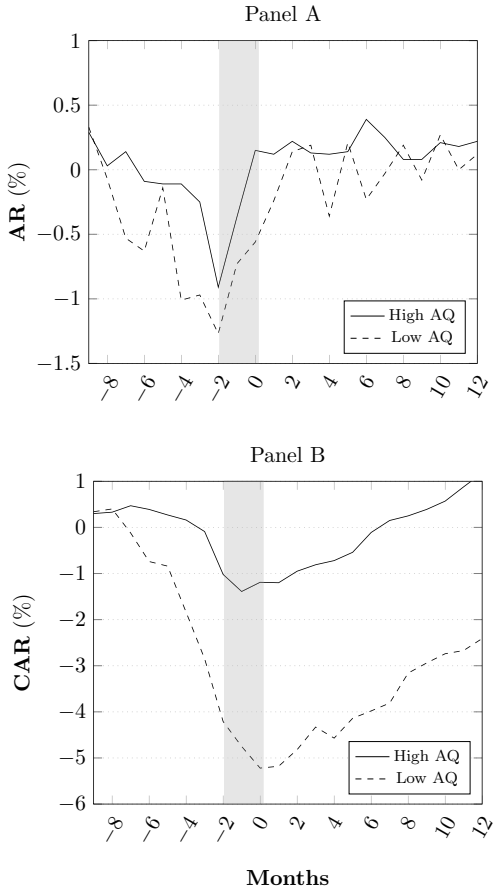
this reduced sample are presented in Table 6. In Panel A we present the results for the main proxies for accounting quality, $Decile\_DD\_MN$ (McNichols, 2002) and $Decile\_DD$ (Dechow and Dichev, 2002), and in Panel B we exhibit the results for accounting conservatism, $Decile\_CScore$ and $Decile\_TCons$ (Khan and Watts, 2009).

The results presented in Table 6 are qualitatively the same after excluding multiple shocks. Both the economic and the statistical significance are fairly stable compared to the benchmark results (see Tables 2 and 4 for comparison). To ensure that these results are robust, we re-run the regressions including the additional market-based and firm complexity controls, exclude financial, regulated and quasi-governmental firms, use median regression and all the aforementioned conclusions hold. Overall, the results are stronger when we use the augmented McNichols (2002) proxy for accounting quality, and for the broader event window.

3.5 Conclusions

This paper shows that accounting quality plays a very important role in stock valuation when firms suffer from exogenous underpricing caused by mutual funds liquidity needs that temporarily deviate prices from fundamental value. We find that, in this setting, firms with better accounting quality have a lower price impact, exhibiting less negative cumulative abnormal returns. We show that the results are not driven by firm complexity, and are robust to a wide set of robustness tests. Overall, we conclude that having better accounting quality reduces mispricing in setting in which other market participants cannot timely react to support stock prices.

Figure 1: Abnormal returns around mutual funds fire sales



The figures show the abnormal returns (Panel A) and cumulative abnormal returns (Panel B) for firms with high (High AQ) and low (Low AQ) accounting quality. The former includes firms in the first and second quintiles, while Low AQ includes firms in the fourth and fifth quintiles of AQ_DD_MN (McNichols, 2002). The horizontal axes represent the quarters relative to the event, and the event goes from [-2,0] (shaded).

Table 1: Summary statistics

	Full sample						High AQ		Low AQ	
	n	Mean	S.D.	0.25	Mdn	0.75	n	Mdn	n	Mdn
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
AQ_DD_MN	7775	-0.283	0.399	-0.336	-0.201	-0.120	4083	-0.12	1770	-0.52
AQ_DD	7775	-0.129	0.248	-0.152	-0.091	-0.053	4083	-0.06	1770	-0.21
C_Score	6712	0.111	0.065	0.072	0.113	0.150	3588	0.11	1424	0.13
Total_Score	6712	0.122	0.051	0.091	0.125	0.155	3588	0.12	1424	0.14
CAR^{mm}_{0}	7775	-1.510	17.18	-11.37	-1.599	8.34	4083	-1.08	1770	-3.09
CAR^{4f}_{0}	7775	-1.937	18.09	-12.18	-1.896	7.97	4083	-0.96	1770	-4.21
$CAR^{mm}_{1,0}$	7775	-2.698	23.45	-16.16	-2.414	10.64	4083	-1.25	1770	-5.18
$CAR^{4f}_{1,0}$	7775	-3.474	24.53	-17.89	-3.295	10.30	4083	-1.59	1770	-7.37
$CAR^{mm}_{1,1}$	7775	-2.322	28.20	-18.30	-2.328	13.69	4083	-0.99	1770	-6.00
$CAR^{4f}_{1,1}$	7775	-3.463	29.88	-20.31	-3.166	12.81	4083	-0.98	1770	-8.89
Pressure	7775	1.856	1.350	0.870	1.380	2.410	4083	1.32	1770	1.45
MktCap	7775	6.759	1.454	5.751	6.651	7.681	4083	7.08	1770	5.94
Mkt_to_Book	7775	0.530	0.498	0.170	0.437	0.805	4083	0.43	1770	0.51
Size	7775	6.635	1.495	5.604	6.546	7.561	4083	6.98	1770	5.70
OperCycle	7672	141.6	236.5	71.6	113.2	164.6	4030	114	1743	110
S_CFO	7747	0.075	0.202	0.033	0.051	0.078	4067	0.04	1766	0.09
S_Sales	7747	0.216	0.195	0.103	0.165	0.269	4067	0.13	1766	0.25
NegEarn	7775	0.194	0.242	0.000	0.100	0.300	4083	0.00	1770	0.30
InstHold	7775	0.723	0.206	0.601	0.758	0.872	4083	0.78	1770	0.70
LnNumEst	7775	1.863	0.705	1.386	1.792	2.398	4083	1.95	1770	1.61
AVol	7617	1.050	0.412	0.804	0.979	1.199	3998	0.99	1731	0.94
HLtoH	7774	0.128	0.063	0.085	0.114	0.153	4083	0.10	1769	0.14
Ret	7770	1.231	4.833	-1.254	1.220	3.733	4083	1.22	1767	1.39
Turnover	7618	1.745	1.238	0.900	1.430	2.225	3999	1.38	1732	1.58
Spread	7774	0.253	0.544	0.056	0.117	0.240	4083	0.10	1769	0.17
SDRet	7770	0.103	0.059	0.064	0.089	0.126	4083	0.08	1767	0.11

Columns (1) to (5) present summary statistics for the full sample. Columns (6)-(7) and (8)-(9) show summary statistics for the subsample of high and low accounting quality, respectively (High AQ (Low AQ) includes firms in the first and second (fourth and fifth) quintiles of AQ_DD_MN). AQ_DD and AQ_DD_MN are Dechow and Dichev (2002) and McNichols (2002) proxies for earnings quality, respectively. C_Score and Total_Score are Khan and Watts (2009) proxies for accounting conservatism. CAR^{k}_{t} is the cumulative abnormal return for window t around the event ($t = 0, (-1,0), (-1,1)$) using model j ($k = mm, 4f$). $Pressure$ is constructed following Equation 3.2. $MktCap$ ($Size$) is the natural logarithm of stock market capitalization (total assets), Mkt_to_Book is the natural logarithm of the book-to-market ratio. $OperCycle$ is the length of the operating cycle, S_CFO (S_Sales) is the volatility of cash flows (sales), and $NegEarn$ is the incidence of negative earnings. $InstHold$ is the fraction of shares owned by institutional investors, and $LnNumEst$ is the log of one plus the number of analysts issuing EPS forecasts. $AVol$ is the abnormal trading volume, $HLtoH$ is the ratio of the stock high and low price difference and the high price, Ret is the average raw return, $Turnover$ is the monthly stock turnover, $Spread$ is the stock spread, and $SDRet$ is the standard deviation of stock returns.

Table 2: The effect of accounting quality on stock mispricing

	Panel A: Four factor model					
	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.255	0.603	0.708			
	(2.539)	(4.175)	(3.753)			
Decile_DD				0.157	0.418	0.636
				(1.560)	(2.901)	(3.433)
Pressure	-0.227	-0.631	-0.345	-0.224	-0.624	-0.337
	(-1.236)	(-2.604)	(-1.172)	(-1.218)	(-2.576)	(-1.147)
MktCap	-0.052	0.205	0.123	0.026	0.350	0.177
	(-0.215)	(0.612)	(0.292)	(0.106)	(1.028)	(0.414)
Mkt_to_Book	-0.747	0.792	0.484	-0.845	0.608	0.415
	(-1.416)	(1.059)	(0.468)	(-1.598)	(0.814)	(0.402)
InstHold	-3.723	-2.785	-5.091	-3.697	-2.746	-5.122
	(-3.091)	(-1.627)	(-2.293)	(-3.065)	(-1.602)	(-2.305)
LnNumEst	-0.283	-1.344	-0.972	-0.301	-1.370	-0.953
	(-0.615)	(-2.013)	(-1.127)	(-0.651)	(-2.041)	(-1.099)
Firms	2,057	2,057	2,057	2,057	2,057	2,057
Observations	7,775	7,775	7,775	7,775	7,775	7,775
Adj. R2	0.014	0.017	0.017	0.014	0.016	0.017
	Panel B: Market model					
	CAR_0^{mm}	$CAR^{mm}{}_{1,0}$	$CAR^{mm}{}_{1,1}$	CAR_0^{mm}	$CAR^{mm}{}_{1,0}$	$CAR^{mm}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.404	0.889	1.134			
	(3.886)	(5.980)	(5.860)			
Decile_DD				0.290	0.613	0.920
				(2.763)	(4.127)	(4.752)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firms	2,057	2,057	2,057	2,057	2,057	2,057
Observations	7,775	7,775	7,775	7,775	7,775	7,775
Adj. R2	0.044	0.054	0.064	0.043	0.051	0.062

This table reports the results of the effect of accounting quality on stock mispricing. In Panel A (Panel B) the abnormal returns are calculated using the four factor model (market model). Columns (1) to (3) present the results for the augmented McNichols (2002) model, and Columns (4) to (6) show the results for the (unmodified) Dechow and Dichev (2002) model. All regressions include industry and quarter-year fixed effects. Robust t-values are reported below the coefficient estimates.

Table 3: Robustness tests

Panel A: Additional market-based controls						
	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.182	0.504	0.630			
	(1.729)	(3.330)	(3.190)			
Decile_DD				0.098	0.320	0.564
				(0.951)	(2.184)	(2.987)
Observations	7,614	7,614	7,614	7,614	7,614	7,614
Adj. R2	0.017	0.021	0.020	0.016	0.020	0.019
Panel B: Median regressions						
	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.391	0.667	0.745			
	(4.208)	(4.902)	(5.040)			
Decile_DD				0.313	0.538	0.827
				(3.407)	(3.919)	(5.658)
Observations	7,775	7,775	7,775	7,775	7,775	7,775
Pseudo R-sq.	0.015	0.020	0.020	0.014	0.019	0.020
Panel C: Excluding financial, regulated and quasi-governamental firms						
	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.240	0.583	0.678			
	(2.325)	(3.891)	(3.488)			
Decile_DD				0.131	0.385	0.612
				(1.260)	(2.576)	(3.199)
Observations	7,337	7,337	7,337	7,337	7,337	7,337
Adj. R2	0.014	0.017	0.018	0.014	0.016	0.017

This table presents robustness tests to the main results of the paper. In Panel A we include a set of market based controls ($AVol$, $HLtoH$, Ret, $Turnover$, $Spread$ and $SDRet$) that might potentially affect abnormal returns (Ben-Rephael et al., 2017b). In Panel B we show the results using median regressions to account for non-normal errors and outliers (Hilary, 2008). In Panel C we exclude financial (SIC 6), regulated (SIC 49) and quasi-governamental (SIC 9) firms (Hilary, 2008). All regressions include firms controls and industry and time fixed effects. Robust t-values are reported below the coefficient estimates.

Table 4: Accounting quality or firm complexity?

Panel A: Four factor model and firm complexity						
	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$	CAR^{4f}_{0}	$CAR^{4f}_{1,0}$	$CAR^{4f}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.197	0.523	0.628			
	(1.808)	(3.354)	(3.055)			
Decile_DD				0.088	0.309	0.536
				(0.826)	(2.032)	(2.785)
MktCap	-0.141	0.058	0.005	-0.091	0.150	0.028
	(-0.575)	(0.168)	(0.012)	(-0.368)	(0.432)	(0.063)
OperCycle	-0.000	0.001	-0.001	-0.000	0.001	-0.001
	(-0.081)	(0.364)	(-0.434)	(-0.043)	(0.455)	(-0.364)
S_CFO	-0.078	-0.605	0.330	-0.052	-0.502	0.531
	(-0.081)	(-0.417)	(0.129)	(-0.053)	(-0.338)	(0.204)
S_Sales	-0.725	0.446	-1.248	-1.116	-0.455	-2.025
	(-0.562)	(0.234)	(-0.489)	(-0.891)	(-0.244)	(-0.817)
NegEarn	-1.557	-3.204	-2.863	-1.835	-3.773	-3.169
	(-1.330)	(-1.887)	(-1.275)	(-1.562)	(-2.216)	(-1.422)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firms	2,014	2,014	2,014	2,014	2,014	2,014
Observations	7,644	7,644	7,644	7,644	7,644	7,644
Adj. R2	0.015	0.018	0.017	0.014	0.017	0.016
Panel B: Market model and firm complexity						
	CAR^{mm}_{0}	$CAR^{mm}_{1,0}$	$CAR^{mm}_{1,1}$	CAR^{mm}_{0}	$CAR^{mm}_{1,0}$	$CAR^{mm}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.341	0.805	1.014			
	(3.001)	(4.992)	(4.768)			
Decile_DD				0.203	0.477	0.751
				(1.822)	(3.049)	(3.705)
Firm complexity	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,644	7,644	7,644	7,644	7,644	7,644
Adj. R2	0.046	0.056	0.065	0.045	0.053	0.063

In this table we control for firm complexity proxied by the length of the operating cycle, volatility of cash flows, volatility of sales, the incidence of negative earnings over the past 10 years (Francis et al., 2005). We also control for firm size using MktCap. In Panel A (Panel B) the dependent variable is the cumulative abnormal return using the four factor (market) model. All regressions include industry and quarter-year fixed effects. Robust t-values are reported below the coefficient estimates.

Table 5: Accounting conservatism and stock mispricing

Panel A: Baseline model						
	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_CScore	0.119	0.263	0.747			
	(0.734)	(1.141)	(2.501)			
Decile_TCons				0.079	0.414	0.927
				(0.401)	(1.472)	(2.533)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,711	6,711	6,711	6,711	6,711	6,711
Adj. R2	0.013	0.015	0.016	0.013	0.015	0.016
Panel B: Median regressions						
	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_CScore	0.208	0.521	0.612			
	(1.685)	(2.734)	(2.912)			
Decile_TCons				0.175	0.597	0.732
				(1.214)	(2.692)	(2.929)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,712	6,712	6,712	6,712	6,712	6,712
Pseudo R-sq.	0.015	0.020	0.020	0.015	0.020	0.020
Panel C: Firm complexity						
	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$	CAR_0^{4f}	$CAR^{4f}{}_{1,0}$	$CAR^{4f}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_CScore	0.148	0.340	0.804			
	(0.903)	(1.472)	(2.697)			
Decile_TCons				0.119	0.508	0.993
				(0.603)	(1.800)	(2.715)
Firm complexity	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,611	6,611	6,611	6,611	6,611	6,611
Adj. R2	0.014	0.017	0.018	0.014	0.017	0.018

This table presents the results when we use accounting conservatism as an alternative proxy for accounting quality. In Panel A we present the results for the baseline regression, in Panel B we show the median regression results, and in Panel C we also control for firm complexity. All regressions include industry and quarter-year fixed effects. Robust t-values are reported below the coefficient estimates.

Table 6: Additional tests - Multiple shocks

Panel A: Earnings quality						
	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_DD_MN	0.300	0.573	0.814			
	(2.228)	(3.241)	(3.751)			
Decile_DD				0.066	0.270	0.693
				(0.481)	(1.474)	(3.116)
Observations	4,323	4,323	4,323	4,323	4,323	4,323
R-squared	0.014	0.013	0.016	0.013	0.011	0.015
Panel B: Accounting conservatism						
	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$	CAR_0^{4J}	$CAR^{4J}{}_{1,0}$	$CAR^{4J}{}_{1,1}$
	(1)	(2)	(3)	(4)	(5)	(6)
Decile_CScore	0.132	0.122	0.773			
	(0.626)	(0.428)	(2.231)			
Decile_TCons				0.151	0.285	0.988
				(0.570)	(0.811)	(2.313)
Observations	3,684	3,684	3,684	3,684	3,684	3,684
R-squared	0.012	0.011	0.011	0.012	0.011	0.011

This table shows the results when multiple shock in the same year are dropped. Panel A presents the results for the alternative proxies of earnings quality (Decile_DD_MN and Decile_DD), and Panel B shows the estimates for accounting conservatism (Decile_CScore and Decile_Total_Score). All regressions include industry and quarter-year fixed effects. Robust t-values are reported below the coefficient estimates. All regression coefficients are standardized.

Chapter 4

Appendix to Chapter 2

A A Simple Model

This Appendix presents a simple asymmetric information model with a numerical example to illustrate how actual repurchases can be used by good firms to signal their type. The model closely follows Tirole (2010).[1]

Assumptions and notation

The model has two periods. At $t = 0$, firms have liquid assets, A, that can be used to repurchase stock, or they can keep them until $t = 1$, to invest. For simplicity, I assume that firms either use all available cash to repurchase shares or repurchase nothing. There is one project available to all firms at $t = 1$ that requires an initial investment, $I > A$, and will generate two random payoffs at $t = 2$, R with probability p_i and 0 with probability $(1 - p_i)$. There are two types of firms, good (G) and bad (B), and they differ only in the probability of success, $p_G > p_B$. There is a fraction α of good firms and a fraction $(1 - \alpha)$ of bad firms. Assume that $p_G R > I - A$ (at least the good type is creditworthy).

There is asymmetric information at $t = 0$ and $t = 1$ regarding firm type. Risk-neutral managers run the firm, and they know the type of their firm. They are compensated with a fraction, δ, of the firm at $t = 0$, and they cannot trade their shares until $t = 2$.[2]

[1] See Chapter 6, Corporate Financing Under Asymmetric Information.

[2] It could instead be assumed that managers can sell their stake in the firms and investors can observe their trades; therefore, investors will infer that the firm is bad (good) if managers are selling (buying) because the firm is overvalued (undervalued). In this case, insider trading rather than stock repurchases would be the signaling device. I empirically test whether insider purchases are driving the results in Section 2.4. Notice, however, that insiders are subject to stricter trade disclosure requirements than are firms, thereby making stock repurchases more attractive mechanisms to engage in *indirect* insider trading (Fried, 2014). Moreover, even when insider purchases could substitute for stock repurchases as a signaling device, diversification motives and financial constraints could prevent insiders

Because δ is constant over time, the maximization of the manager's utility is equivalent to maximizing the firm's equity value. I assume that investors are rational, risk neutral, and know the probability distribution of firms' types, i.e., the fraction of good and bad firms, and their probability of success, but they cannot distinguish an individual firm's type. Consequently, they will break even on average. The investors' prior probability of success is $m = \alpha p_G + (1 - \alpha)p_B$. The number of shares outstanding is normalized to 1, and the risk-free interest rate is normalized to zero.

At $t = 1$, firms go to the capital markets to raise money to invest in the project,[3] and they have to disclose in their financial statements the number of shares repurchased and the price paid at $t = 0$. Investors might infer the firm's type from its repurchase activity: they observe the repurchase price, and they infer that if the price is sufficiently high, the company must be good. The timing of events is described in Figure A1.

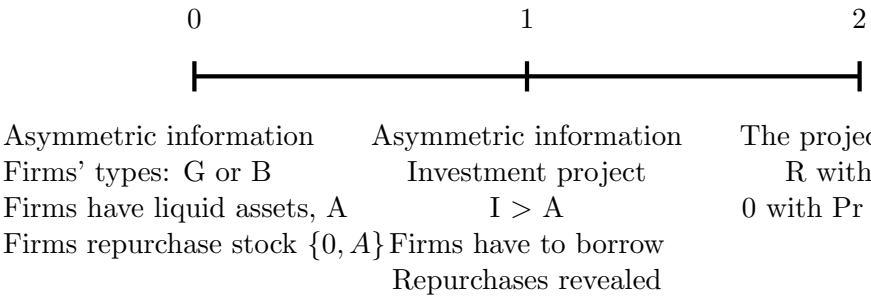


Figure A1: Timeline

Perfect information equilibrium

I will first analyze the perfect information case without repurchases, to set a benchmark (of course, the result will be the same with repurchases, as there are no frictions in this case (Modigliani and Miller, 1958; Miller and Modigliani, 1961)). At $t = 0$, firms do nothing, and, at $t = 1$ the good firm obtains financing. One optimal arrangement is to secure financing in case of success, R_G, consistent with the investors' break even condition:[4]

$$p_G(R - R_G) = I - A \tag{A.1}$$

from buying firm shares.

[3]All firms have to borrow regardless of the payout decision because liquid assets are insufficient to finance the project ($I > A$).

[4]There is an indeterminacy on the firm compensation with perfect information, and contracts in which the firm receives a positive compensation in the case of failure are possible. However, in the asymmetric information case a contract that rewards the firm only in the case of success best reflects the good firm comparative advantage, as it is more likely to succeed than the bad one (Tirole, 2010). Therefore, choosing this contract here case eases the comparison with the asymmetric information setting.

If $p_B R < I - A$, at $t = 1$, the bad firm cannot secure financing because it does not have enough pledgeable income. If $p_B R < I - A$, the bad firm optimal arrangement, is $p_B(R - R_B) = I - A$ in the event of success, and zero in the case of failure. Therefore, the firm's equity value is

$$V_i = p_i R - I + A. \tag{A.2}$$

It is clear from Equation A.2 that the value of good firms will be higher than the value of bad firms because $p_G > p_B$. Consider next the case with stock repurchases and symmetric information. At $t = 0$, firms use all cash available to repurchase shares (a fraction, β, of shares outstanding), and at $t = 1$, they have to borrow I to invest. The borrowers' contract is $R_i = R - I/p_i$, and the firm's equity value is as follows:

$$V_i^{'} = \frac{p_i R - I}{1 - \beta_i}. \tag{A.3}$$

Then, the firm's value will be equal to the benchmark if and only if $\beta_i = A/(p_i R - I + A)$, that is, if the firms repurchase shares at the fundamental value.

Numerical Example. Consider the following numerical example. The probability of success for good and bad firms is $p_G = 0.8$ and $p_G = 0.5$, respectively. Firms have cash on hand $A = 1$ and the project requires an investment of $I = 2$ and it will yield $R = 5$ in case of success. The proportion of good firms is $\alpha = 0.5$. Under symmetric information, from Equation A.2 the firm's equity value is $V_G = 3$, $V_B = 1.5$, that is exactly the value with stock repurchases if good and bad firms repurchase 0.33 and 0.66 of shares outstanding with the cash available, respectively. That is, with cash equal to 1, and a firm value of 3, the firm can repurchase 1/3 of the shares outstanding at the fundamental value, while the bad firm can repurchase 1/1.5.

Asymmetric information equilibria

In the asymmetric information case (without repurchases), the standard result implies that, if firms cannot differentiate themselves, there will be cross-subsidization or market breakdown (Akerlof, 1970). If firms are creditworthy on average, $mR > I - A$, in equilibrium, investors break even, and the firm is compensated with zero in the case of failure, and R_P in the event of success, such that

$$m(R - R_P) = I - A \tag{A.4}$$

Then, the firm's equity value in the pooling equilibrium, V_i^P, will be

$$V_i^P = p_i(R - \frac{I - A}{m}). \tag{A.5}$$

It is straightforward that $V_G \geq V_G^P \geq V_B^P \geq V_B$ because $p_G/m > 1 > p_B/m$. If $mR < I - A$, there is market breakdown (no lending), even when some firms are creditworthy, i.e., there is underinvestment.

Under asymmetric information, both good and bad firms will be traded at the cross-sectional average, V_{CS}. In this case, $V_{CS} = \alpha V_G + (1 - \alpha)V_B$, and good firms are undervalued, while bad firms are overvalued, and this creates an opportunity for firms to

signal through stock repurchases. However, by repurchasing at the cross-sectional value, good firms cannot separate themselves because bad firms would always mimic. That is, from the incentive compatibility constrain of the bad firm, it can be shown that they will always mimic because:

$$p_B R - I + A < \frac{p_B}{1 - \beta_{CS}}(R - \frac{I}{m}),$$

where $\beta_{CS} = A/(mR - I + A)$. It is straightforward to see that bad firms would always mimic at the cross-sectional level because $\frac{p_B}{m} < 1$:

$$p_B R - I + A < p_B R - (I - A)\frac{p_B}{m}.$$

Note that if $A > I$, firms do not need to borrow to finance the project, and good-firm managers can increase their utility by both investing in the project and engaging in bargain repurchases. In this case, repurchases do not induce a change in investment, as firms would have been able to invest without stock repurchases.[5]

Numerical Example *(cont.)*. In the asymmetric information case, without any signaling mechanism, firm's equity values are $V_G^P = 2.77$ and $V_B^P = 1.73$. While good firms are better off when they signal their type, they cannot do so by repurchasing shares at the cross-sectional value. An alternative price at which good firms could repurchase is their fundamental value. Consider the figures of the previous example. With repurchases, the good firm will be valued $V_G = 3$ (without mimicking). If bad firms want to pretend to be good, they have to repurchase shares at the good-firms price, i.e., $V_G = 3$. If they mimic good ones, they will receive the pooling contract, and the firm value will be: $V_B^P = 1.44$, that is lower than the firm value in the separating equilibrium. Therefore, they won't mimic. Then, in equilibrium good firms repurchase at $t = 0$, and bad firms do nothing. At $t = 1$ investors verify the number of shares repurchased and the price paid and infer the firm type. Then, each firm will borrow at a cost of capital according to their type. Notice that the signaling is *costless*, because both firms obtain the symmetric information value. Finally, one can check that there exists a price below the good-firm value such that bad firms will not mimic. In the example presented above, the price is 2.79. In this case, managers of good firms are better off because they are paying less than the fundamental value to selling-shareholders $V_G^{'} = 3.12$, but rational investors would not accept this price because they will infer it comes from good firms, and will demand V_G.

Then, at least for some parameter values, good firms could repurchase shares at fundamental value price, and bad firms do not mimic. Moreover, when the asymmetric information problem is severe, meaning that the supply of bad firms is large relative to the supply of good firms, actual repurchases become more attractive for good firms because

[5]This is possible because repurchase activity is disclosed with some lag, and therefore, at $t = 0$, investors cannot determine whether they are trading against informed or uninformed investors. Fried (2014) argues that insiders have incentives to trade on private information using repurchases to exploit weaker disclosure requirements of they have, compared to direct insider trading, which has to be disclosed within 2 days.

cross subsidization is larger. The following example illustrates this idea in the current setting.

Numerical Example *(cont.)* Assume that $\alpha = 0.9$ (that is, most firms are good), business as usual. In that case, the good firm should repurchase 0.199 of the firm with the cash available to separate from the bad firm, but the value of equity in this case $V_G^{'} = 2.5$ is lower than in the pooling equilibrium $V_P^G = 2.96$. Therefore, no one will repurchase shares in this case. With a sufficiently large fraction of good firms ($m \to p_G$), share repurchases are zero in equilibrium. In the current example, for $\alpha < 0.64$ in equilibrium good firms repurchase shares and bad firms do not mimic. However, for $0.56 < \alpha < 0.64$ the repurchase price should be above the fundamental value price.

More formally, the good firm manager chooses the fraction of the firm that she is going to buy back, β, with the cash available, A (price and quantity are jointly determined when A is fixed), such that bad firms do not mimic, and investors are willing to sell,[6]

$$\begin{aligned} \max_{\beta} \quad & \frac{p_G R - I}{1-\beta} \\ \text{s.t.} \quad & p_B R - I + A \geq \frac{p_B}{1-\beta}(R - \frac{I}{m}) \\ & \beta \leq \frac{A}{p_G R - I + A} \end{aligned} \tag{A.6}$$

From the above equations it follows that β^* will be,

$$\beta^* = \min\{\frac{A}{p_G R - I + A}, \frac{A - (1 - \frac{p_B}{m})I}{p_B R - I + A}\} \tag{A.7}$$

Finally, the manager compares the firm value in the pooling (Eq. A.5) and the separating equilibrium with repurchases (Eq. A.3). It follows that:

$$\begin{cases} \beta^{**} = \beta^* & \text{if } \beta^* > 1 - \frac{m(p_G R - I)}{p_G(mR - I + A)} \\ \beta^{**} = 0 & \text{if } \beta^* \leq 1 - \frac{m(p_G R - I)}{p_G(mR - I + A)} \end{cases}$$

So far it has been assumed that firms use all cash available to repurchase shares. This assumption can be justified, omitting a formal proof. Asymmetric information means that the firm is mispriced at $t = 0$, and there will be wealth transfers. Repurchases imply a larger cost for bad firm managers, and good firms, realizing that, will repurchase the largest possible amount. Failure of firms to put up to A would signal that the firm is bad.

Three final comments are in order. First, note that dividends cannot substitute for stock repurchases as a signaling tool. The reason is that both firms can distribute A in the form of cash dividends at $t = 0$ and will have to borrow I at $t = 1$. Because both

[6]Rational investors would interpret any deviation from the cross-sectional value as coming from informed investors, and therefore, they would not accept a price below V_G in equilibrium.

managers receive a fraction, δA, of dividends, the bad-firm manager will always mimic, and there will be no separating equilibrium. In other words, there is no wealth transfer for that manager to induce her not to mimic with dividends. Second, there is an increase in investment with stock repurchases whenever there is market breakdown without signaling. Under cross-subsidization, this simplified asymmetric information model fails to explain the increase in investment. However, the inverse relationship between the cost of capital and investment predicts that a decrease in the former will increase the latter.

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